

Dytran Guide BASIC FSI SETUP





In this example a rigid box dropped on a open water environment. This example is extracted and modified from the Dytran DYT101 Training Seminar as a basic introduction to Dytran FSI setup.

Other standard training course workshops are shown on the next page.

For more information please contact MSC Software.



| MSC Software | | MSC Software |
|--|-----------------------------------|---|
| WORKSHOP 2 FLUID INTERACTION | WORKSHOP 4 EFP MINE | WORKSHOP 7 Blast Inside Container |
| | | |
| MSC Software | MSC Software | |
| WORKSHOP 3.1 BIRDSTRIKE | WORKSHOP 5 BUNKER BLAST | WORKSHOP 8.1 SUBMARINE UNDEX |
| | | |
| MSC Software | | |
| WORKSHOP 3.2 BIRD STRIKE WITH FAILURE | WORKSHOP 6.1 LAGRANGE vs EULER | WORKSHOP 8.2 SUBMARINE UNDEX SUBMESHES |
| | | |

This workshop is integral to the training notes detailing the pre- and postprocess steps.

COURSE NOTES SECTION 7: Patran Model Processing for Dytran FSI

- 1. Get familiar with the Patran Dytran preference for FSI setup
- 2. How to define a simple Euler mesh and assign initial states using a basic material model

COURSE NOTES SECTION 8: Dytran FSI Process

- 1. How to run Dytran FSI
- 2. Understanding the Dytran ouput files

COURSE NOTES SECTION 9: Dytran FSI Results Processing

1. How to convert and view FSI results with Paraview







Step 1. Files: Create a New Database

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| Menu Home | N # | | Options 🔹 📝 |
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| | Orientation Misc. Special | Group Picking | |
| : File- Group- View Viewing- Display- Preferences- Tools- Help- Utilities- | | | |
| The Group-View View of Dipley- Preferences- Tools- Help- Utilities- New- Open CriteR Open Recent CriteR Session Print Session Print Guit CriteS Guit CriteS Guit CriteS Guit CriteS Session Print Open new database and name 2_w01. a) Open File Menu and click New. b) Type box_drop under File name and click OK. c) Select Dytran for Analysis Code and click OK | New Database Template Database Name C:\MSC.Software\Patran\20170b/template.db C:\MSC.Software\Patran\20170b/template.db Change Template Modify Preferences Set Working Directory to Database Location Look in: C:\Temp Wy Computer My Computer My Computer Pesktop Documents File name: *.db Files of type: Database Files (*.db) | RHS Window New Model Preference Model Preference for: W1.db Tolerance Based on Model Default Approximate Maximum Model Dimension: 10.0 Analysis Code: MSC.Dytran Cox Cancel OK Reset | |
| | | re [.] | |

Step 2.1 Geometry: Create / Coord

| Menu | Hor | me Geor | netry | Properties | Loads/BC | Cs Mest | hing Analy | sis Results | Patran 2017 | - 🖻 × (a) @ Options + 🔀 |
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| Select | Select | Select | Select | Select | Select | Select | Select | 1 1 | Show Edit Verify Renumber Delete Associate Disassociate | |
| Points | Curves | Surfaces | Solids | Coordinates | Planes | Vectors | P-Shapes | Transform | Geometry Actions | |
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File+ Group+ Viewport+ Viewing+ Display+ Preferences+ Tools+ Help+ Utilities+

| | | | | RHS Window |
|--------------|-------------------------------------|--|---|--|
| Crea Coor | te a rotated | e box_drop.db - default_viewport - default_group - Group | RHS Window Geometry Rotation Parameters First Rotation Axis: About Axis 1 * C Angle of Rotation 30 d | Geometry Action: Create Object: Coord Method: Euler Coord ID List 1 |
| a) | Geometry: Create / Coord / Euler | | Second Rotation | Type: Rectangular Refer. Coordinate Frame Coord 0 |
| b) | Select Rotation Parameters | ZY | Angle of Rotation 0.0 | Rotation Parameters b |
| C) | Set About Axis 1 | * | | ✓ Auto Execute Origin |
| d) | Set rotation at 30° | | Axis: About Axis 3 Angle of Rotation | f |
| e) | Click OK | | 0.0 | |
| f) | Click Apply . | Z XY | | |
| | | MSC Software [.] | OK Cancel | MSC Software* Simulating Reality, Delivering Certainty* |

Step 2.2 Geometry: Create / Solid / XYZ

| Menu | Hon | ne Geor | netry | Properties | Loads/BC | Cs Mesh | ing Analy | sis Results | Patran 2017 | - 6 × × |
|--------|--------|----------|--------|-------------|----------|-------------|-----------|-------------------|--|---------|
| Select | Select | Select | Select | Select | Select | 1 Select | Select | Ø ≁ 🛤 😝 ,⊱ 🛃 1 | The effective of the second se | |
| Points | Curves | Surfaces | Solids | Coordinates | Planes | Vectors | P-Shapes | Transform | Geometry Actions 2 | |

File+ Group+ Viewport+ Viewing+ Display+ Preferences+ Tools+ Help+ Utilities+



- a) Geometry: Create / Solid / XYZ
- b) Select Coord 1 as Reference Coord
- c) Click Apply.







Step 3.1 Elements: Create / Mesh / Surface



Step 3.2 Elements: Equivalence / All



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Step 4. Materials: Create / Isotropic

| Define | material | properties. |
|--------|----------|-------------|
| | | |

Geometry

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2D

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File - Group - Viewport - Viewing - Display - Preferences - Tools -

- a) Materials: Create / Isotropic / Manual Input.
- b) Enter rigid for Material Name.

Properties Loads/BCs

Meshing

1 5 2

OD Properties

1D Properties

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2D Properties

- c) Click on Input Properties.
- d) Constitutive Model: Rigid (MATRIG) Valid For: Shell
 - Rigid Body Properties: Defined
- e) Enter:

7850 for Density,

210e9 for Elastic Modulus

- 0.3 for Poisson Ratio
- -10 for Initial Z-Vel of CG
- f) Click **OK**.
- g) Click Apply.

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|----------|--|---|
| Solid So | id 🏔 🖾 🗶 🕋 📾 😹 | |
| | HS Window | × |
| | Materials | |
| 1 | Action: Create * | |
| | Object: Isotropic * | |
| | Method: Manual Input * | |
| | Existing Materials | |
| | Filter Mate Dame rigid | |
| | Description Date: 19-May-17 Time: 22:29:18 | |
| | Input Properties | |
| | Appl | * |

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| input Options | |
|-----------------------------|------------------|
| onstitutive Model: | Rigid (MATRIG) - |
| lid For: | Shell T |
| gid Body Properties: | Defined - |
| roperty Name | Value |
| ensity = | 7850 |
| lastic Modulus = | 210e9 |
| oisson Ratio = | 0.3 |
| ass = | |
| -coordinate of CG = | |
| -coordinate of CG = | |
| -coordinate of CG = | |
| nertia Ixx about CG = | (e) |
| nertia Ixy about CG = | |
| nertia Ixz about CG = | |
| nertia Iyy about CG = | |
| nertia Iyz about CG = | |
| nertia Izz about CG = | |
| nitial X-Vel. of CG (Vx) = | |
| nitial Y-Vel. of CG (Vy) = | |
| nitial Z-Vel. of CG (Vz) = | -10 |
| nitial X-Rot. about CG (Wx) |) = |
| nitial Y-Rot. about CG (Wy) | = |
| nitial Z-Rot. about CG (Wz) | = |
| | |
| urrent Constitutive Models: | |
| (f) | |
| OK | Clear Cancel |

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Step 5. Properties: Create / 2D / Shell

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Define properties for the surface

- a) Properties: Create / 2D / Shell
- Enter **box** for Property Set b) Name.
- Option(s): Homogeneous / C) Default(PSHELL)
- d) Click Input Properties.
- Select rigid for Material e) Name.
- Enter 0.001 for Sheet f) Thickness.
- Click OK. g)
- h) Select Application Region
- Select All elements for i) Select Members
- Click Add then click OK. j)
- k) Click Apply

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|---------------------------------------|----------------------------|-----------|
| agrangian Eulerian 🎧 🔀 💥 🖀 🗃 🗃 | P Input Properties | |
| 3D Properties Property Actions Fields | Default PSHELL (CQUAD4) | |
| H Window | Property Name | Value |
| Element Proper | Material Name | m:rigid e |
| Action: Create | [Material Orientation] | |
| Object: 2D * | Thickness | 0.001 (f) |
| Type: Shell - | [Hourglass Suppr.Meth.] | |
| | [Inpl.Hourgl.Damp.Coeff.] | |
| Sets By: Name 🔻 🖺 | [Warp.Hourgl.Damp.Coeff.] | |
| | [Twist.Hourdl.Damp.Coeff.] | |
| | | |
| | | |
| | Field Definitions | |
| Filter | | |
| Property Set Name | | |
| | | |
| Options: | | |
| Homogeneous • (C) | ок д | Clear |
| Default (PSHELL) 🔻 | <u></u> | |
| | | |
| Input Properties (| | |
| Select Application Region 1 | | |
| | | |
| Apply | | |
| (k) | | |
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Step 6. Loads/BCs: Create / Rigid Body Object

| Menu Hom | e Geometry Properties Loads/BCs Meshing Analysis Results | Patran 2017 | | | | | | |
|---------------------------|---|---|--|---|----------------------|-----------------------------------|-------------|---------------------------------|
| Displacement Fo | * Follower Body Velocity BJOIN KJOIN Rotational Detonation Wave Generator Nodal | 😌 📩 🖣 💉 🏂 🍐 💌 RHS Window | ial Conditions | No No No No Rigid | LBC Actions | Create Load Case Load Cases | IBC Fields | |
| N 🖾 🗋 🖼 🗖 | ◎⋌⋦⊕◎●धは~ぉヰ┓┍ӊま∥⊠⋓⊠⊎◎ | Load/Boundary Conditions | | | | | | |
| Crea rigid a) b) | te constraints on the body. Loads/BCs: Create / Rigid Body Object. Enter rbo for New Set | Action: Create V (2) Object: Rigid Body Object V Type: Nodal V Current Load Case: Default Type: Time Dependent | P Inpu Load/E 1.0 Filter * | t Data IC Set Scale Fact Specification | or Filte | r dy or Rigid Su | face | |
| c) d) | Name. Click on Input Data . Select rigid material | Existing Sets | Rigid | Body Constraint | | Time Depen | dent Fields | 1256 |
| e) | Set fixed DOF for UX, UY, RY, RZ | | ⊻ UX V UY | e | □ RX V RY V RZ | | | RHS Window |
| f) | Click OK . | | Enfor | ed Transl. Vel. V | ector | * Time Dep | endence | Geometry Filter |
| g) | Click Select Application Region. | New Set | <0.,0 Enford <,0., | .,> ced Rot. Vel. Vec D.> Vector | tor | * Time Dep | endence | Geometry ● FEI(h) |
| h) | Select FEM for Geometry Filter. | | <,,> Mome <,,> | nt Vector | | * Time Dep | endence | Rigid Reference Node Node 36 |
| i) | Select Any node. | | | OK C | | | R | |
| i) | Click OK . | Input Data | | | | | | ок (ј) |
| k) | Click Apply . | Select Application Regio g | MSCX | Software [.] | | | | |
| | | ▼ | | | | | | MSC Software* |

Step 7. Loads/BCs: Create / Coupling







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Step 8.1 Materials: Create / Isotropic Patran 2017 Loads/BCs Geometry Properties Meshing ---🍅 💰 🌒 XX 器 曲 協 28 38 3% a 数数 Lagrangian Eulerian 🏩 🔀 💥 Isotro 2D \$a 12 1 Solid Solid 1D Properties 3D Properties Orthotropic Anisotropi **OD** Properties 2D Properties **RHS Window** × 1 S 5 11 Materials File-Group+ Viewport+ Viewing+ Display+ Preferences+ Tools+ . Action: Create * Object: Isotropic * Input Options Method: Manual Input * Constitutive Model: Ideal Gas (DMAT) -Define Euler material properties. d Valid For: Eulerian Solid (Hydro) -2 a) Materials: Create / Isotropic / Manual Existing Materials Property Name Value rigid Input. 1.14 Density = Specific Heat Ratio (GAMMA) = 1.4 b) Enter air for Material Name. e 287 Gas Constant (R) = c) Click on Input Properties. Spec. Heat at Const. Volume = Spec. Heat at Const. Pressure = d) Constitutive Model: Ideal Gas (DMAT) Viscosity Coefficient = Valid For: Eulerian Solid e) Enter: Filter 1.14 for Density, Materia me 1.4 for GAMMA b air Current Constitutive Models: 287 for R Description Click OK. f) Date: 19-May-17 Time: 22:29:18 g) Click Apply. OK Clear Cancel f С Input Properties ... Change Material Status ... Apply σ ulating Reality, Delivering Certainty 16

Step 8.2 Materials: Create / Isotropic Patran 2017 Ontions * Loads/BCs Properties Meshing ~ 1 1 5 2 **** e) Lagrangian Solid 20 1 2 1 **RHS Window** x 1D Properties 3D Pro Orthotropic **OD** Properties 2D Properties Materials 2 11 ER 1 . Eile -Group+ Viewport+ Viewing+ Display+ Preferences+ Tools+ Action: Create * Object: Isotropic * Input Options Method: Manual Input -Constitutive Model: LinFluid (DMAT) d Define Euler material properties. Valid For: Eulerian Solid (Hydro) * 2 Existing Materials a) Materials: Create / Isotropic / Manual air Property Name Value rigid Input. 1000 Density = b) Enter water for Material Name. Bulk Modulus = 2.2e9 e Cavitation Pressure = c) Click on Input Properties. Volume Cutoff Tolerance d) Constitutive Model: LinFluid (DMAT) Hydro, Volume Limit = Valid For: Eulerian Solid Filter e) Enter: 1000 for Density, Material Name b water 2.2e9 for Bulk Modulus Click OK. f) Current Constitutive Models: Description g) Click Apply. Date: 19-May-17 Time: 22:29:18 OK Clear Cancel С Input Properties ... Change Material Status ... Apply lating Reality, Delivering Certainty 17

Step 9. Properties: Create / 3D / Eulerian

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| I nome deprinting analysis kesults | |
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| よ ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● | RHS Window |
| pic Orthotropic Anisotropic Composite 0D Properties 1D Properties 2D Properties 3D Properties Troperty Actions Fields | Element Properties |
| D 译 函 微 紧 条 载 @ ● H 性 * * * # H H H * * * # H H H * * * # H * * * # # * * * # * * * * | Action: Create - |
| | Object: 3D - |
| efine properties for the surface | Type: Eulerian Solid - |
| a) Properties: Create / 3D / Eulerian | |
| Solid | Sets By: Name 🔻 🖺 |
| b) Enter euler fer Drenert (Cet Nerre | |
| b) Enter euler for Property Set Name. | |
| c) Options: MMHYDRO (PEULER <u>1</u>) | |
| d) Click Apply | Filter * |
| | Property Set Name |
| | euler b |
| | Options: |
| | MM/Hydro (PEULER1) - C |
| | |
| | Input Properties |
| | Select Application Region |
| | Apply |
| | Apply d |
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Step 10. Loads/BCs: Create / Mesh Generator



Step 11.1 Loads/BCs: Create / Init Cond Euler



Step 11.2 Geometry: Create / Coord

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|--|--|--|---|
| Menu Home Geometry Properties Loads/BCs Meshing Anal Image: Select Sel | xsis Results | Disassociate | Options - D |
| : File+ Group+ Viewport+ Viewing+ Display+ Preferences+ Tools+ Help+ Utilities | | | |
| Create a rotated Coord. a) Geometry: Create / Coord / Euler b) Select Rotation Parameters c) Set About Axis 1 d) Set rotation at 0° e) Click OK f) Set Origin to [0 0 -10] g) Click Apply. | E box_drop.db - default_viewport - default_group - Group Z Y | RHS Window Geometry Rotation Parameters Action: Create ▼ Object: Coord ▼ Amethod: Euler ▼ Coord ID List 2 Type: Refer. Coord ID List 2 Type: Refer. Coord ID List 2 Refer. Coord ID List 2 Y Refer. Coord ID Rotation Parameters ✓ Auto Execute Origin [0 0 -10] f | Geometry Rotation Parameters First Rotation Axis: About Axis 1 Angle of Potation 0 Second Rotation Axis: About Axis 1 Angle of Rotation 0.0 Third Rotation Axis: About Axis 3 Angle of Rotation 0.0 Cancel |
| | KY MSC Software | 24 | MSC Software Simulating Reality, Delivering Certainty |

Step 11.3 Loads/BCs: Create / Init Cond Euler



Step 11.4 Loads/BCs: Create / Init Cond Euler



Step 11.5 Loads/BCs: Create / Init Cond Euler



Step 11.6 Loads/BCs: Create / Init Cond Euler



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Step 12.1 Analysis: Analyze / Input Deck

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File* Group* Viewport* Viewing* Display* Preferences* Tools* Help* Utilities*

Set up analysis

- a) Analysis: Analyze / Input Deck / Translate
- b) Click on Translation Parameters.
- c) Select **Free** for Card Format.
- d) Click OK.

| IS Wind | ow |
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| Analys | is |
| Action | Analyze 🔻 |
| Object | : Input Deck • a |
| Method | I: Translate 🔻 |
| Code: | MSC.Dytran |
| Type: | Structural |
| Availat | le Jobs 📲 |
| Job Na box_d | me rop |
| Job Na box_d Job De MSC.I May-1 | me rop scription Dytran job created on 19- 7 at 23:12:24 |
| Job Na box_d Job De MSC.I May-1 | me rop scription Dytran job created on 19- 7 at 23:12:24 |
| Job Na box_d Job De MSC.I May-1 | me rop scription Dytran job created on 19- 7 at 23:12:24 anslation Parameters |
| Job Na box_d Job De MSC.(I May-1 | me scription Dytran job created on 19- 7 at 23:12:24 anslation Parameters initiating Calculation Execution Controls |
| Job Na box_d Job De MSC.I May-1 | me scription Dytran job created on 19- 7 at 23:12:24 anslation Parameters Initiating Calculation Execution Controls Select Load Cases |
| Job Na box_d Job De MSC.I May-1 | me rop scription Dytran job created on 19- 7 at 23:12:24 anslation Parameters initiating Calculation Execution Controls Select Load Cases Output Requests |
| Job Na box_d Job De MSC.I May-1 | me rop scription Dytran job created on 19- 7 at 23:12:24 anslation Parameters initiating Calculation Execution Controls Select Load Cases Output Requests Output Controls |
| Job Na box_d Job De MSC.I May-1 | me rop scription Dytran job created on 19- 7 at 23:12:24 anslation Parameters initiating Calculation Execution Controls Select Load Cases Output Requests Output Requests Direct Text Input |

| -Bulk Data Format | <u> </u> |
|-------------------------|---------------------|
| Card Format | Free • C |
| Min. Significant Digits | 6 - |
| 🖉 Separate Mesh File | |
| Include Data Files | |
| Select Case Co | ntrol Include Files |
| | |
| Select Bu | IK Data Files |
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Step 12.2 Analysis: Analyze / Input Deck

| | | Patran 2017 | | | |
|--|--|---|--------------------------------|------------------------------|-----------------|
| Menu Hom | e Geometry Properties Loads/BCs Meshing Analysis Results | | ~ | 28324 | a 🕜 Options 🔹 🔀 |
| | | 9 6 | Execution Controls | Execution Control Parameters | |
| Entire Current Model Group Analyze | Analysis Read Archive History State Deck File File File Archive Access Results Delete Actions Special | RHS Window | Execution Control Parameters | CPU Time | |
| N 🗋 🗋 🖼 🗠 | 0 % 🖗 🕸 🗊 📦 🖻 🖢 ~ 중 🕈 🐄 🖛 🛊 🍏 🗹 💷 🖾 🕸 | Analysis | Element/Entity Activation | Integer Memory Size | |
| File+ Group+ Vi | ewport* Viewing* Display* Preferences* Tools* Help* Utilities* | Action: Analyze | | | |
| | | Object: Input Deck * (2) | Dynamic Relaxation | Float Memory Size | |
| | | Method: Translate * | Sub-Cycling Parameters | Time-Step Control | |
| | | | Eulerian Parameters | End Step | 9999999 (d) |
| Defir | e execution control | Code: MSC.Dytran | ALE Parameters | End Time | 0.1 |
| para | meters | Type: Structural | General Parameters | Time-Step Size at Start | 1e-7 |
| a) | Analysis: Analyze / | Available Jobs | Inertial Loads | Minimum Time Step | |
| u) | Input Deck / Translate | | Application Sensitive Defaults | Maximum Time Step | |
| | | | Default Gridpoint Constraints | Time-Step Scale Factor | f |
| D) | Click Execution | | Gridpoint Offset | Lagr. Time Step Sc. Fact. | 0.9 |
| | Controls. | Job Name | | | |
| 2 | Click Execution | Job Description | Coupling Parameters | License Control | |
| C) | Click Execution | MSC.Dytran job created on 19- May-17 at 23:12:24 | Contact Parameters | | <u>, 199</u> |
| | Control Parameters. | | Variable Activation | Mass Scaling | |
| d) | Enter 0.1 for End | | Bulk Viscosity Parameters | Activate Mass Scaling | No - |
| , | Time | Translation Parameters | Hourglass Parameters | Min. Allowable Time Step | |
| | | Initiating Calculation | nou glass rarameters | Max. Perc. of Mass Incr. | |
| e) | Enter 1.0e-7 for Time | Execution Controls b | User Subroutine Parameters | Steps for Freq. Checks | |
| , | Sten Size at Start | Output Requests | Rigid Body Merging | | |
| | | Output Controls | Add CID to MATRIC | (g) | |
| t) | Set Lag Time Step | Direct Text Input | Add CID to MATRIG | ок | Cancel |
| • | Scale Factor to 0 .9 | [] | ОК | Ľ | |
| , | | Apply | | | |
| g) | Click OK . | | <u>}</u> | | |



Step 12.3 Analysis: Analyze / Input Deck

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Define execution control parameters

- a) Select Coupling Parameters
- b) Set Fast Coupling to **Active**
- c) Click **OK**
- d) Select Inertia Loads
- e) Set Gravity Scale Factor to **9.81**
- f) Set Gravity vector in Z = -1
- g) Click **OK**
- h) Click OK

| n Controls | |
|----------------------------|--------------|
| Execution Control Parame | ters |
| Element/Entity Activation | n |
| Dynamic Relaxation. | |
| Sub-Cycling Parameter | s |
| Eulerian Parameters. | • |
| ALE Parameters | |
| General Parameters. | |
| Inertial Loads | (d |
| Application Sensitive Defa | ults |
| Default Gridpoint Constra | ints |
| Gridpoint Offset | |
| Coupling Parameters. | a |
| Contact Parameters. | |
| Variable Activation | 5 |
| Bulk Viscosity Paramete | rs |
| Hourglass Parameters | |
| User Subroutine Paramet | ers |
| Rigid Body Merging | |
| Add CID to MATRIG. | |
| ок | \mathbf{D} |



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9.81

Inertial Loads

Gravity Scale Factor

Global x-Direction Global y-Direction

Gravitation

Step 12.4 Analysis: Analyze / Input Deck

Creating output requests.

- a) Enter **arc_euler** for Result Name.
- b) Select **Archive** for File Type.
- c) Select **Element Output** for Result Type.
- d) Select Times for Output
- e) Enter **1e-3** for 0 THRU END BY (Time)
- f) Click Add.
- g) Select ALLMULTIEULHYDRO for Select Groups for Output.
- h) Select **Eulerian Solids** for Entity Type
- i) Select XVEL, YVEL, ZVEL, DENSITY, PRESSURE, FMAT, FMATPLT, VOID for Result Types.
- j) Click **Apply**.

| P Output Requests | _ _ × |
|--|--------------|
| Output Requests Request Summary | |
| a Result Name arc_euler File Type: Archive * Result Type: Element Output * | |
| Times for Output * Sampling Rate * 0 THRU END BY (Time) 1e-3 C | |
| Number of Savings per File | Delete |
| ОК | Cancel |



Step 12.5 Analysis: Analyze / Input Deck

Creating output requests.

- a) Enter arc_structure for Result Name.
- b) Select Archive for File Type.
- c) Select Element Output for Result Type.
- d) Select Times for Output
- e) Enter 1e-3 for 0 THRU END BY (Time)
- f) Click Add.
- Select default_group for g) Select Groups for Output.
- h) Select **Dummy** for Entity Type
- Select user-specified for i) Result Types.
- Click Apply. i)

| P Output Requests |
|------------------------------------|
| Output Requests Request Summary |
| arc_euler |
| Result Name |
| |
| Archive T |
| Result Type: |
| Element Output |
| Times for Output • d |
| Sampling Rate * |
| 0 THRU END BY (Time) |
| 1e-3 (e) |
| Number of Savings per File |
| |
| Add f Modify Delete |
| |
| OK |



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Step 12.6 Analysis: Analyze / Input Deck

Creating output requests.

- a) Enter **ths_couple** for Result Name.
- b) Select **Time History** for File Type.
- c) Select **Coupling Surface Ths Output** for Result Type.
- d) Select Times for Output
- e) Enter **1e-5** for 0 THRU END BY (Time)
- f) Click **Add**.
- g) Select **couple** for Select Surfaces for Output.
- h) Select **all outputs** for Result Types.
- i) Click Apply.

| Output Requests |
|-------------------------------------|
| - Output Requests |
| arc_euler arc_structure |
| |
| Result Name |
| ths_couple a |
| File Type: |
| Time History • (b) |
| Result Type: |
| Coupling Surface Ths Output |
| Times for Output |
| 0 THRU END BY (Time) |
| 1e-5 (e) |
| Number of Savings per File 10000 |
| Add Modify Delete |
| OK Cancel |
| |





Step 12.7 Analysis: Analyze / Input Deck

Creating output requests.

- a) Enter **ths_mat** for Result Name.
- b) Select **Time History** for File Type.
- c) Select Material Output for Result Type.
- d) Select Times for Output
- e) Enter **1e-5** for 0 THRU END BY (Time)
- f) Click **Add**.
- g) Select **all materials** for Select Materials for Output.
- h) Select **all outputs** for Result Types.
- i) Click **Apply**.
- j) Click **OK**.

| P Output Requests |
|--|
| Output Requests Request Summary |
| arc_euler arc_structure ths_couple |
| Result Name |
| ths_mat a |
| Time History * |
| Result Type: Material Output T |
| Times for Output |
| 0 THRU END BY (Time) |
| 1e-5 (e) |
| Number of Savings per File 10000 |
| Add Modify Delete |
| OK j Cancel |

| Analysis | Select Output | |
|---|---|---|
| Current Vi | ewport | |
| default_vi | ewport | |
| ilter Spec | ification | |
| * | | |
| | Filter | |
| Select Mat | erials for Output | |
| air | | |
| rigid water | (g) | - |
| | | |
| | Select None | |
| | Builder Hone | |
| | Select All | |
| | Select Current | |
| esults Typ | bes | |
| YMOM - y- ZMOM - y- EKIN - kin EINT - inte EDIS - dis VOLUME - | component of mome component of mome etic energy arnal energy tortional energy volume | |



Step 12.8 Analysis: Analyze / Input Deck

Add additional entries to modify and write out input deck.

- Select Direct Text Input. a)
- Select Bulk Data Section. b)
- Enter C)

```
HYDSTAT,888, #WATER MA
```

\$

FLOWDIR, 999, MMHYDRO, #

- , FLOW, BOTH +
- Click OK. a)
- Click Apply. b)

| | | Code | MSC.Dytran |
|--|---------------------------|--------------|---|
| ERIAL ID#,,,0,0,0,101350 | | Avai | lable Jobs |
| ESH ID#,POSZ,,,,,+ | | | |
| | | Job | Name |
| Direct Text Input | | - - × | rop |
| | | | scription |
| Bulk Data Section | | | Dytran job created on 19- 17 at 23:12:24 |
| HYDSTAT,888,#WATER MATERIAL ID#,,,0,0,0,101350 | \sim | | |
| \$ FLOWDIR 999 MMHYDRO #MESH ID# POSZ + | (c) | | |
| + ,FLOW,BOTH | \smile | | ranslation Parameters |
| | | | Initiating Calculation |
| | | | Execution Controls |
| | | | Select Load Cases |
| | | | Output Requests |
| | | | Output Controls |
| | | | Direct Text Input |
| | | | a a a a a a a a a a a a a a a a a a a |
| C File Management Section | M EMS Write To Input Dook | | Analy |
| Executive Control Section | EXEC Write To Input Deck | | |
| Case Control Section | CASE Write To Input Deck | | |
| Bulk Data Section | RULK Write To Input Deck | | |
| | BOLK WITE TO INPUT DECK | | |
| ок (d) Clear | Reset | Cancel | |
| | | WSU | Software |
| 33 | | | Simulating Reality, Delivering Certainty |

RHS Window Analysis

Action:

Object:

Analyze -Input Deck '

Method: Translate

Step 13 Analysis: Input Deck Edit

Edit Input deck with special features.

- a) Add additional output breakdown per material.
- b) Fix HYDSTAT to water material ID.
- c) Fix FLOWDIR to MESH ID.

d) Save.

```
$ Output result for request: arc euler
TYPE (arc euler) = ARCHIVE
ELEMENTS (arc euler) = 1
                                                                                 a
SET 1 = ALLMULTIEULHYDRO
ELOUT (arc euler) = XVEL YVEL ZVEL DENSITY PRESSURE VOID FMAT FMATPLT FMATPLT2,
 FMATPLT3 DENSITY2
TIMES (arc euler) = 0 THRU END BY 1e-3
SAVE (arc euler) = 10000
. . . .
HYDSTAT, 888, 3, , , 0, 0, 0, 101350 (b)
$
FLOWDIR, 999, MMHYDRO, <u>6</u>, POSZ, , , , , + (c)
        ,FLOW,BOTH
+
. . . .
---- Material air id =2
DMAT,2,1.14,2
EOSGAM, 2, 1.4, 287,,
$
$ ----- Material water id =3
DMAT, 3, 1000, 3
EOSPOL, 3, 2.2e+009
$ ----- Mesh Box: mesh
MESH, 6, BOX, , , , , , +
       ,-1,-1,-2,3,3,3.5,,,+
+
      ,31,31,36,,,,EULER,2
+
```



SECTION 5 INTERRUPT

Dytran FSI Process



Step 14. Dytran Analysis on Linux

Create alias to Dytran run script: \$ alias dytran=/msc/Dytran/2017/bin/Dytran

To run:

\$ dytran jid=jobname [options]

Execute this workshop:

\$ dytran jid=2_w01 nproc=4 ncpus=1 dmp=both intelmpi=yes



Step 14. Dytran Analysis on Windows

Execute Dytran

- a) Select **DytranDMP** execulable and set to **2** cores
- b) Select 2_w01.dat file.
- c) Click "**Play**" icon.
- After analysis, make sure
 ARC and
 THS files
 were created
 in output
 window.

| Dytran Explorer | |
|---|---|
| le Tools Help Window | |
| 4 🖄 🖾 🔀 | |
| Dytran Job [1] | |
| Dytran Explorer | |
| File Explorer | Input Files |
| Name | 2_w01.bdf (h) |
| ⊳ 🎴 w02 | 2_w01.dat |
| ⊳ 🍌 w03 | |
| ⊳ <u>w</u> 04 | |
| ▶ wus ▶ w12 | |
| ▷ 退 w13 | |
| ⊳ 🎍 w15 | Output Files |
| ⊳ w 16 | |
| > w17 | 2 W01.001 |
| ⊳ 📙 w20 | 2_W01_FILE_SUMMARY.MSG |
| ⊳ 🎍 w21 | 2_W01_NASTRAN_IGNORE.MSG |
| ▷ ₩01-2 | 2 W01_THS_COUPLE_0.THS CU |
| V Workshops P | |
| 4 III >> | VTU/PVD |
| | |
| Executables Job Info | |
| Dytrap No CPUs Elapsed time : 1 | 00:02:21 |
| | C:\MSC.Software\Dytran\2017\\dytranexe\dytrandmp. |
| anput File : | 2_w01.dat |
| User modified User routines : | |
| | |
| | |
| | 100% |
| | |
| 53:07 Fri May 19 2017 | ware |

SECTION 6 INTERRUPT

Dytran FSI Results Processing



Step 15. Dytran Time History

Viewing time histories are possible directly by Dytran Explorer

- a) Double Click the **COUPLE.THS** file shown in the Output files window.
- b) Select **all results** for the Y-axis

| | Dytran Explorer | | |
|-----------------------------------|---|--|---------------|
| | File Tools Help Window | | |
| | 🛱 🖄 🖾 🔀 | | |
| | Dytran Job [1] | | |
| | Dytran Explorer | | |
| | File Explorer | Input Files | |
| | Name | ▲ 2_w01.bdf | |
| Dytran Explorer | | 2_w01.dat | |
| File Tools Help Window | | | |
| 🛱 🖄 🖾 🔀 | | | |
| Visual Time History Viewer | | | |
| | | Output Files | |
| | | 2 W01 OUT | |
| X: 0.0397219 Y: 96513.2 | | 2_W01_ERROR_SUMMARY.MSG | |
| 2_W01_THS_COU | JPLE_0.THS | 2_W01_FILE_SUMMARY.MSG 2_W01_NASTRAN_IGNORE.MSG | a MSG |
| RFORCE vs. TIME W XFORCE vs. TIME | FORCE vs. TIME ZFORCE vs. TIME | 2_W01_THS_COUPLE_0.THS | THS |
| 5.3e+04 | | 2_W01_THS_MAT_0.THS | ARC/RST |
| 4.3e+04 | | | VTU/PVD |
| 8.4e+04 | | | |
| 8 2.4e+04 | Ala . | | Î |
| 1.4e+04 | With Martin Martin and | p2:21 | |
| 4.1e+03 | | 4SC.Software\Dytran\2017\\dytrane | ce\dytrandmp. |
| -1.6e+04 | the MMA . Make address on the second | /01.dat | |
| 0 0.0091 0.018 0.027 0.036 0.04 | IS 0.055 0.064 0.073 0.082 0.091 0. TIME | .1 | |
| | | | |
| 1 | | | 100% |
| THS FIle | xis values manually X-min 0 | | |
| X-avis TIME Style | Hines X-max U.1 | | |
| | node Y-max 6.307e+04 | | |
| Y-axis ZFORCE Clear | r Close Reset Pl | ot | |
| | | | |
| 08:53:07 Fri May 19 2017 | | | Coffusoro |



Step 16. Convert Dytran Result Files

ARC to VTK Converter

- Bundled with Dytran
 - Dytran_installation_dir\bin\exe\arc2vtk.exe
 - Usage:

```
C:\MSC.Software\Dytran\2017\bin\exe\arc2vtk.exe [-ascii] [-vtk] [-nonauto] <archive-file.ARC>
C:\MSC.Software\Dytran\2017\bin\exe\arc2vtk.exe [-ascii] <intfor-file.intfor>
C:\MSC.Software\Dytran\2017\bin\exe\arc2vtk.exe <vtu-file.VTU>
C:\MSC.Software\Dytran\2017\bin\exe\arc2vtk.exe <timehistory-file.THS>
```

Includes THS to CSV Converter

- Easiest method to convert THS data to CSV Format for spreadsheet use
- Converts ARC files to open source VTU format to use with Paraview



Step 17.1 Process Results in Paraview

Open Paraview

- a) File Open and select converted PVD file
- b) Click Apply to process result



🌠 Open File: (open multiple files with <ctrl> key.)

? ×

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Step 17.2 Process Results in Paraview



| | | Extract Generic Dataset Surface |
|----|---|-----------------------------------|
| | 6 | Extract Level |
| | | Extract Location |
| | | Extract Region Surface |
| | | Extract Selection |
| | ۲ | Extract Subset |
| | | Extract Surface |
| | | Extract Time Steps |
| | | FFT Of Selection Over Time |
| | | Feature Edges |
| | | Force Time |
| | | Gaussian Resampling |
| | | Generate Ids |
| | | Generate Quadrature Points |
| | | Generate Quadrature Scheme Dictio |
| | | Generate Surface Normals |
| | 0 | Glyph |
| h) | | Glyph With Custom Source |
| | | Gradiant |







Average node results from element central values

- a) Select euler result object
- b) Select Cell Data to Point Data filter
- c) Click Apply

AMR Connectivity

AMR Contour

AMR CutPlane

AMR Dual Clip

Add Field Arrays

AMR Fragment Integration

AMR Fragments Filter

Angular Periodic Filter

Annotate Global Data

Annotate Time Filter

Append Attributes

Append Datasets

Append Geometry

Cell Data to Point Data

Block Scalars

Calculator

Clean

Cell Centers

Annotate Attribute Data



Step 17.3 Process Results in Paraview



C

3 0

0.5

▼ Magnitude

🖴 🛋 😫 💽

1.1

Display (UnstructuredGridRe Display)

Surface

Edit

Minimum

Maximum

Coloring ◆ VEL

Representation

| Connectivity | | Extract Component |
|---------------------------------|---|------------------------------|
| Contour | | Extract Edges |
| CutPlane | | Extract Generic Dataset Surf |
| Dual Clip | 6 | Extract Level |
| Fragment Integration | | Extract Location |
| Fragments Filter | | Extract Region Surface |
| Field Arrays | | Extract Selection |
| egate Dataset | 9 | Extract Subset |
| ular Periodic Filter | | Extract Surface |
| otate Attribute Data | | Extract Time Steps |
| otate Global Data | | FFT Of Selection Over Time |
| otate Time Filter | | Feature Edges |
| end Attributes | | Force Time |
| end Datasets | | Gaussian Resampling |
| end Geometry | | Generate Ids |
| end Reduce | | Generate Quadrature Point |
| k Scalars | | Generate Quadrature Scher |
| ulator | | Generate Surface Normals |
| Centers | 0 | Glyph |
| Data to Point Data | | Glyph With Custom Source |
| n | | Gradient |
| n Cells to Grid | | Gradient Of Unstructured D |
| n to Grid | | Grid Connectivity |
| | 0 | Group Datasets |
| Closed Surface | | Group Time Steps |
| Generic Dataset | 4 | Histogram |
| pute Derivatives | | Image Data To AMR |
| pute Quartiles | | Image Data to Point Set |
| nectivity | | Integrate Variables |
| ingency Statistics | | Interpolate to Quadrature P |
| our | | Intersect Fragments |
| our Generic Dataset | | Iso Volume |
| vert AMR dataset to Multi-block | | K Means |
| | | |

| Extract Component | Outline Curvilinear DataSet | |
|---------------------------------------|-------------------------------|---------------------------------|
| Extract Edges | ParticlePath | |
| Extract Generic Dataset Surface | ParticleTracer | |
| Extract Level | | Pass Arrays |
| Extract Location | | Plot Data |
| Extract Region Surface | | Plot Global Variables Over Time |
| Extract Selection | | Plot On Intersection Curves |
| Extract Subset | | Plot On Sorted Lines |
| Extract Surface | - | Plot Over Line |
| Extract Time Steps | OH | Plot Selection Over Time |
| FFT Of Selection Over Time | | Point Data to Cell Data |
| Feature Edges | | Point Line Interpolator |
| Force Time | | Point Plane Interpolator |
| Gaussian Resampling | Point Volume Interpolator | |
| Generate Ids | | Principal Component Analysis |
| Generate Quadrature Points | * | Probe Location |
| Generate Quadrature Scheme Dictionary | | Process Id Scalars |
| Generate Surface Normals | {} | Programmable Filter |
| Glyph | Python Annotation | |
| Glyph With Custom Source | Python Calculator | |
| Gradient | Quadric Clustering | |
| Gradient Of Unstructured DataSet | | Random Attributes |
| Grid Connectivity | Random Vectors | |
| Group Datasets | Rectilinear Data to Point Set | |
| Group Time Steps | Rectilinear Grid Connectivity | |
| Histogram | Reflect | |
| Image Data To AMR | Resample AMR | |
| Image Data to Point Set | Resample To Image | |
| Integrate Variables | Resample With Dataset | |
| Interpolate to Quadrature Points | Ribbon | |
| Intersect Fragments | Rotational Extrusion | |
| Iso Volume | Ruler | |
| K Means | SPH Line Internolator | |

Surface Flow

Surface Vectors

Table To Points

Temporal Cache

Synchronize Time

Table To Structured Grid

Temporal Interpolator

Temporal Shift Scale

Temporal Statistics

Tensor Glyph

Tetrahedralize

Texture Map to Cylinder

Texture Map to Plane

Texture Map to Sphere Threshold

Time Step Progress Bar

Tessellate

Transform

Tube

Temporal Particles To Pathlines

Temporal Snap-to-Time-Step

Create Isovolume for water

- Select cellDataToPointData result object a)
- Select Isovolume filter b)
- Set Input Scalar to FMATPLT3 and C) range between 0.5 and 1.1
- Click Apply d)
- **Change Fringe** e)





