Drop Test Analysis with ANSYS/LS-DYNA

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Drop Test Examples

Hand-held controller
Computer Mouse
Medical device
Material specimen impacts
Concrete block on APC turret
Gas Bottle
Nuclear fuel rod container
What is Explicit Dynamics?

**Implicit** \[ M\ddot{x} + C\dot{x} + Kx = F(t) \]
- Invert the stiffness matrix to solve for \( x \)
- Requires iterative solution, and may not converge

**Explicit** \[ F = M\ddot{x} \]
- Solve for \( \ddot{x} \), uncoupled equations, no iterations or convergence
- Stable if \( \Delta t < L/C \) where, \( L= \text{smallest element length} \)
  \[ C= \text{speed of sound} \]
Explicit Dynamics in ANSYS?

ANSYS Explicit

• General purpose code
• Run in Workbench
• Basic FSI capability

AUTODYN

• Advanced version of ANSYS Explicit
• Available as a workbench system but runs in a separate interface
• Developed for ballistics and explosives
• ALE, Euler, SPH and FSI capabilities

LS-DYNA

• General Purpose code
• Implicit, ALE, Euler, SPH, CFD, FSI and EM
• Extensive list of material models, and specialised elements
## Explicit Dynamics in ANSYS?

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LS-DYNA ACT

- Available in the ANSYS App store
- Pre-installed in R18.1
4th CADFEM ANSYS Simulation Conference Ireland & UK
12th and 13th October, Engineers Ireland, Dublin
DROP TEST EXAMPLE

Bicycle Helmet Test
Gravitational Potential Energy \( = mgh \)

Kinetic Energy \( = \frac{1}{2}mv^2 \)

Impact Velocity \( = \sqrt{2gh} \)
DROP-TEST SIMULATIONS

• Explicit dynamics is the ideal tool for the job
• Set-up is easy, with energy used to calculate the impact velocity, and the assembly positioned the split second before impact
• The LS-DYNA ACT provides the perfect combination of the speed and versatility of DYNA and the meshing capabilities, set-up tools and user-friendliness of ANSYS Workbench