

#1252: Radioss – Advanced Mass Scaling

Product: Radioss

Product Version: HyperMesh 12.0 and above

Topic Objective

Advanced Mass Scaling in Radioss

Topic Details

AMS (Advanced Mass Scaling) saves significant computation time by increasing the time step of the model for an explicit computation. This is similar to traditional mass scaling, except that the added mass does not increase the translational kinetic energy of the system.

A non-diagonal mass matrix is used to increase the time step on each line of the mass matrix. The lumped mass, M_0 , is increased with some M value compensated with non-diagonal terms such that the total mass to remain constant. Unlike traditional mass scaling, AMS only modifies high frequencies and does not significantly affect low frequencies of the model.

- Typical speed-up from 3 to 5 times of natural time step solution time
- Additional terms on the mass matrix to increase the time step without changing the physical mass and inertia
 - The mass matrix can no longer be inverted; thus the equation of motion is solved using the conjugated gradient
 - Applications
 - Quasi-static load-case, for e.g.
 - Roof crash
 - Seatbelt anchorage test (ECE-R14)
 - Loading with imposed displacement
 - Solid element model with small mesh size
- Method not recommended for dynamic load-cases (crash, high speed impact, ...)

**Roof crush computed
with AMS**



Starter deck (runname_0000.rad)

- Add **/AMS** to model along with a group of parts to which AMS will be applied
- If no part group is defined, AMS will be applied to the full model

Engine file (runname_0001.rad)

Add **/DT/AMS** with:

- Recommended scale factor: 0.67
- Target minimum time step value:
10 to 20 times the natural element time step

```
/TITLE
Parison
/VERS/140

/DT/AMS/1
0.67 1.15e-4
1e-4
/ANIM/DT
0.000000e+000 1.000000e-001
/TFILE
1.000000e-003
/RFILE
10000 0 0
/PRINT/-1000
/RUN/EXAMPLE4_66/1
8.010000e-001
/ANIM/ELEM/EPSP
/ANIM/ELEM/VONM
/ANIM/VECT/VEL
/ANIM/SHELL/THIC
/ANIM/GZIP
/MON/ON
```

Comments

- The AMS treatment has an associated CPU cost, so this method becomes efficient when the target time is > 10 times the elementary time step.
- AMS is compatible with Single Precision.
- This option is not compatible with all RADIOSS options. In these cases, the target time step will not be honored.