

Use of *INTERFACE_SPRINGBACK to precondition beams for impact analyses

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Abstract

The *INTERFACE_SPRINGBACK card allows LS-DYNA to conveniently export deformed geometry, member stresses and effective plastic strains from one analysis run to another. This facilitates the use of inexpensive implicit analyses to precondition a structure with loads prior to an explicit analysis of a collision or other event of interest.

This paper investigates the usage of the *INTERFACE_SPRINGBACK card as applicable to beam elements. Reasonable agreement is found between implicit-explicit and purely explicit runs, with the former being significantly less computationally demanding.

One limitation of the hybrid process is that the *INTERFACE_SPRINGBACK_DYNA card produces a *dynain* file with stresses and strains to only 10-bit precision, whilst deformed node locations are given to 16-bit precision. In both cases, 6 bits are reserved for scientific notation of sign and magnitude. The effects of this limited dynamic range can be clearly observed during the equilibrium state from the start of the implicit-explicit runs prior to changes in loading.

In many collision scenarios, where the impact contains much more force than the structure is intended to carry in service, the small numerical errors observed due to limited input and output precision should be within acceptable tolerances.

Despite all of LS-DYNA's native inputs and outputs being of relatively low precision, switching the solvers from (32-bit) single precision to (64-bit) double precision has a measurable positive effect on response calculations, especially for complex structures or long analysis periods.