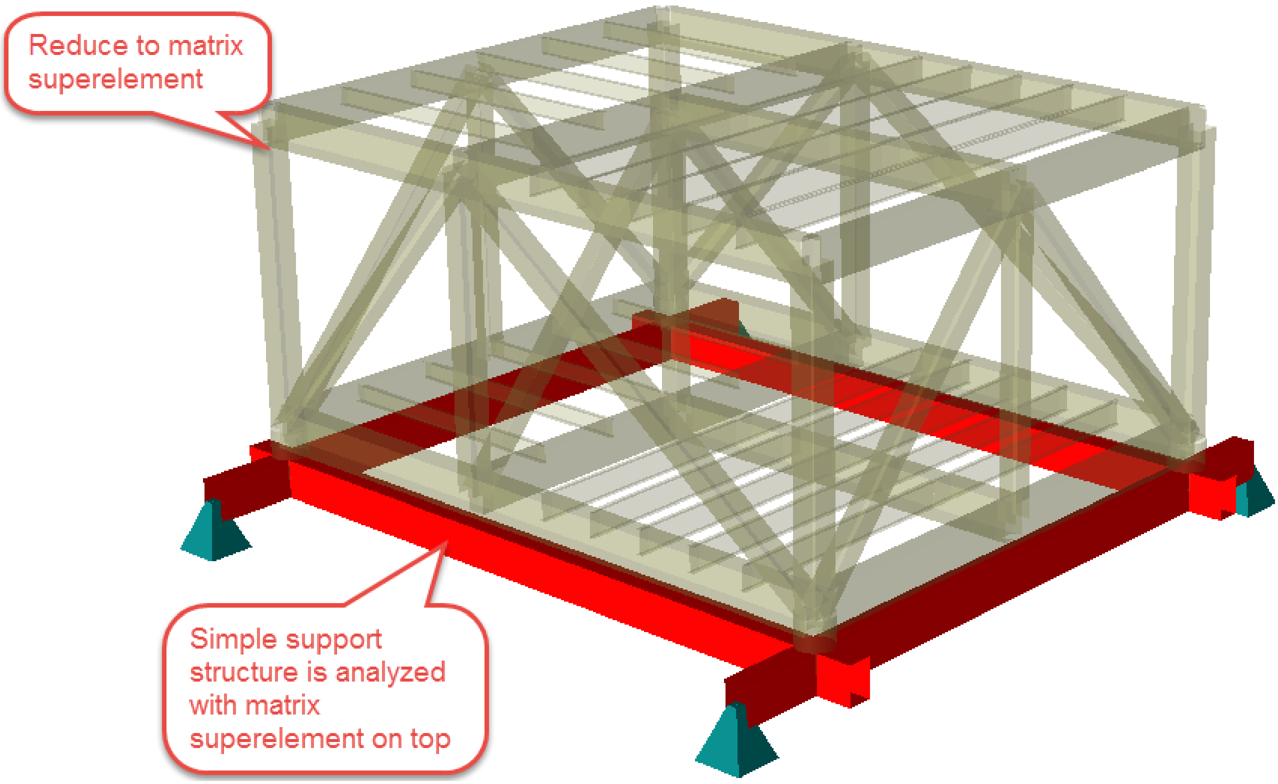
EXPORT AND IMPORT A MATRIX SUPERELEMENT



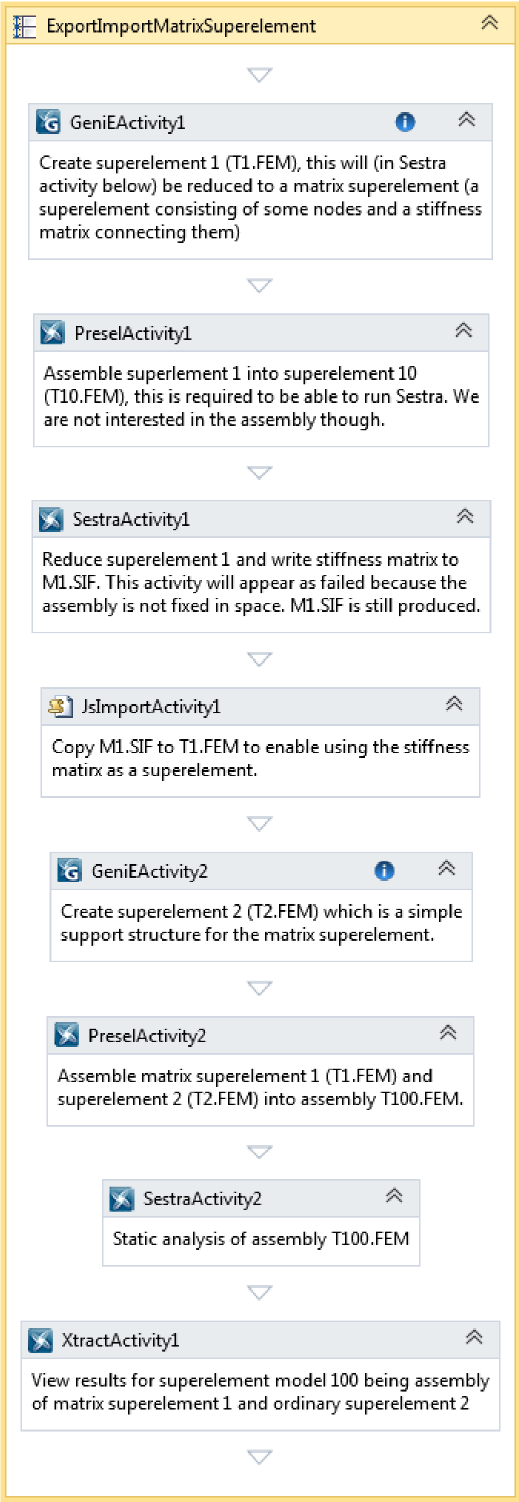
This document explains the example ExportImportMatrixSuperelement. The example shows how to create a matrix superelement by reducing a standard superelement created in GeniE. The advantages of using a matrix superelement compared to using the standard superelement on which it is based are:

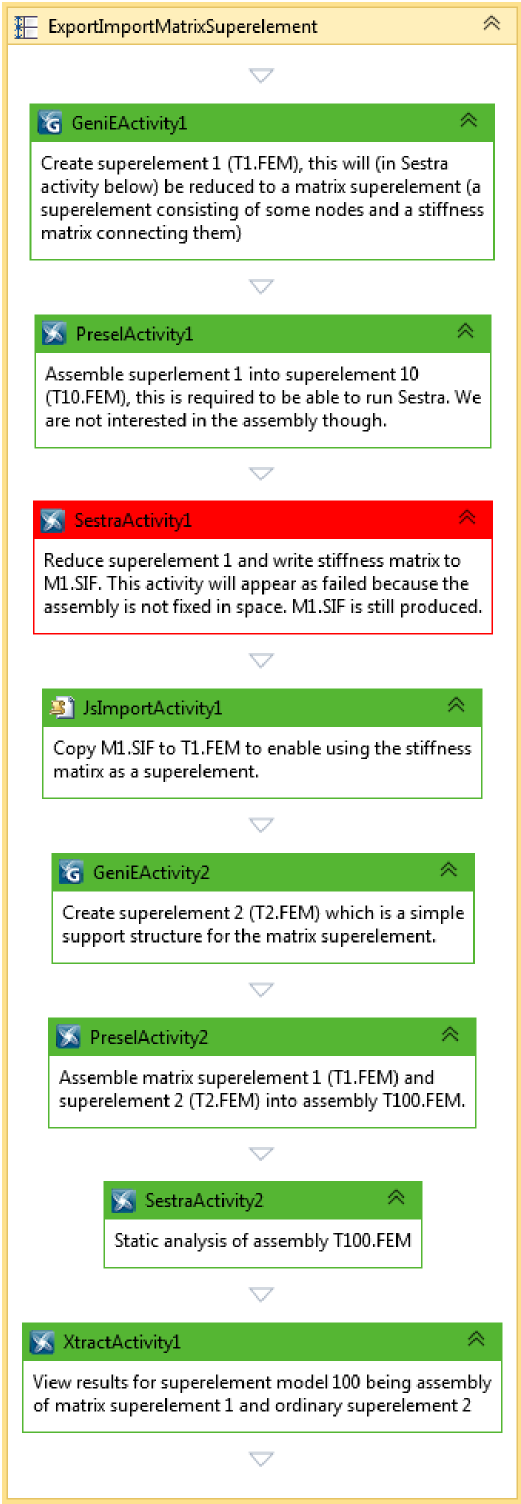
- It has already been reduced, a big model requiring a lot of computer resources may thus be reduced to a matrix superelement and added with little computer cost to another model.
- It is frozen and cannot easily be changed which may be seen as a QA measure.
- It can be stored and used as a matrix superelement in a future analysis, standard components like the module above can thus be stored in a library of matrix superelements.
- It can be used without access to GeniE.

A practical example of using the matrix superelement feature of Sesam is in a cooperation between analysis teams: One team may be in charge of a deck structure which may be a very big model. They create a matrix superelement of the deck, incorporating both stiffness and loads, and pass this on to the team being in charge of the supporting structure. This way the team in charge of the supporting structure does not have to spend computer resources on the deck structure nor risk inadvertently changing the deck model. The cooperation may go both ways: The supporting structure team may send a matrix superelement version of their model to the deck structure team.

1 WORKFLOW

Having imported the ExportImportMatrixSuperelement.zip file into a new Sesam Manager job the workflow analysis process to the left below appears. Some comments to the analysis process follow next page. After running the job the Sestra activity writing the stiffness matrix for the reduced superelement appears as failed as shown to the right below. This is OK as explained next page.





2 COMMENTS TO THE ANALYSIS PROCESS

2.1 Reducing a Superelement and Writing a Matrix File

Any reduced superelement may be written to a Matrix Interface File (M#.SIF/SIU/SIN) in Sesam. By "reduced" is meant having nodes eliminated from the equation system. This is done by a static condensation process, there are no approximations involved in static condensation.

The Sestra command MATR involves writing the matrix file M#.SIF in a format allowing it to be used as a matrix superelement. (As used in connection with a Splice analysis of piles the PILE option on the CMAS command also involves writing an M#.SIF file but this format is not suitable for a matrix superelement.) The MATR command must be preceded by an IDTY command identifying the superelement for which the matrix shall be written. Not only the reduced stiffness of the superelement but also the reduced load vectors are written to the file. The matrix file thus represents the stiffness of and loads on a complete superelement expressed, with no approximations, in the retained nodes.

The process is in short:

1. The model is created in GeniE, in the present example superelement 1. The retained nodes are defined as supernodes. These are the nodes that subsequently are to be coupled with other superelements.

2. Use Presel to include the superelement into a dummy assembly, in this example superelement 10. A dummy load combination must also be made in Presel. It is sufficient to create a single load combination, e.g. based on load case 1 which is gravity in the present example.

3. Run a Sestra static analysis for superelement 10. Unless the dummy assembly is fixed in space the analysis will fail but this has no consequence, the matrix file M#.SIF is still written. The MATR command must be included with the STIF and LOAD parameters set to 1.:
   ```
   COMM  DISP STIF DAMP MASS LOAD
   MATR    0.   1.   0.   0.   1.
   ```

4. The M#.SIF file produced by Sestra is ready to be used as a matrix superelement but must be renamed to T#.FEM.

2.2 Using a Matrix Superelement in an Analysis

Requirements to the model (superelement) to be coupled with the matrix superelement are:

- It must be given a different superelement number, in the present example the matrix superelement is 1 (T1.FEM) so the support structure is given the number 2 (T2.FEM).

- It must have nodes defined as supernodes in the same positions as the retained nodes (supernodes) of the matrix superelement. Both superelements may, however, be translated, rotated and even mirrored when being assembled in Presel in order to achieve matching of these two sets of nodes.

In the present example a very simple support structure is defined as superelement 2: only four intersecting beams. A more realistic example might be a deck structure onto which the matrix superelement is put. And maybe not only in one position but in two or more positions in case the same module is put several places.