CUSTOMER SUPPORT NOTE

Modelling a Hinged Connection Between Surfaces Using Joints

Note Number:	**CSN/LUSAS/1017**

This support note is issued as a guideline only.

LUSAS

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1. Introduction

This support note describes a method for modelling a hinged connection between adjoining surfaces using joint elements. The note focuses on the automatic joint assignment type and assumes that the reader is familiar with the use of joints for modelling connections in LUSAS.

2. Description

Two joint assignment types are available: *On single feature (automatic)* and *Between two features (manual)* (Figure 1). A joint mesh attribute with the assignment type set to *manual* must be assigned to two features (points, lines, or surfaces). These features may be coincident, in which case one feature must be made unmergeable, or they may be non-coincident. In contrast, a joint mesh attribute with the assignment type set to *automatic* must be assigned to a single feature (point, line, or surface). Therefore, the automatic assignment type simplifies the modelling of connections and can be particularly useful in cases such as the one considered in this note.

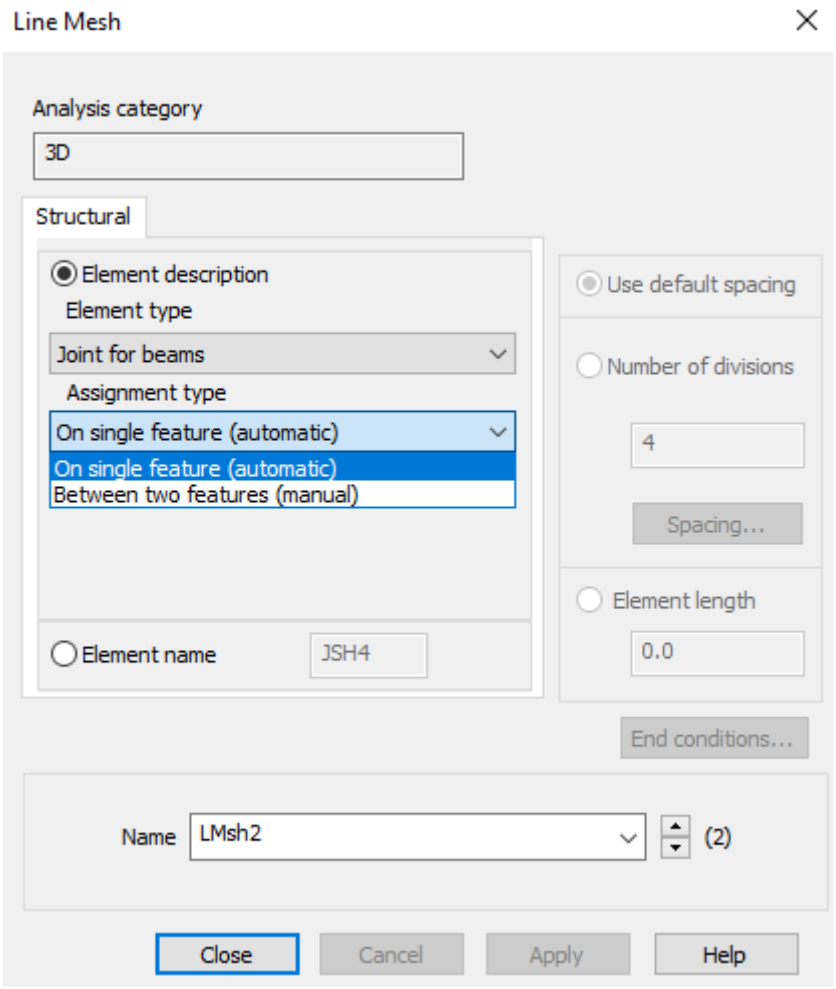

Figure 1 – Assignment type: On single feature (automatic).

3. Illustrative Example

The structure shown in Figure 2 comprises two surfaces that share a common line; therefore, they are rigidly connected along this line. This example demonstrates how a hinged connection between the two surfaces can be modelled. The surfaces are meshed using shell elements, and both ends of the structure are fully fixed. A uniformly distributed load is applied to the structure.

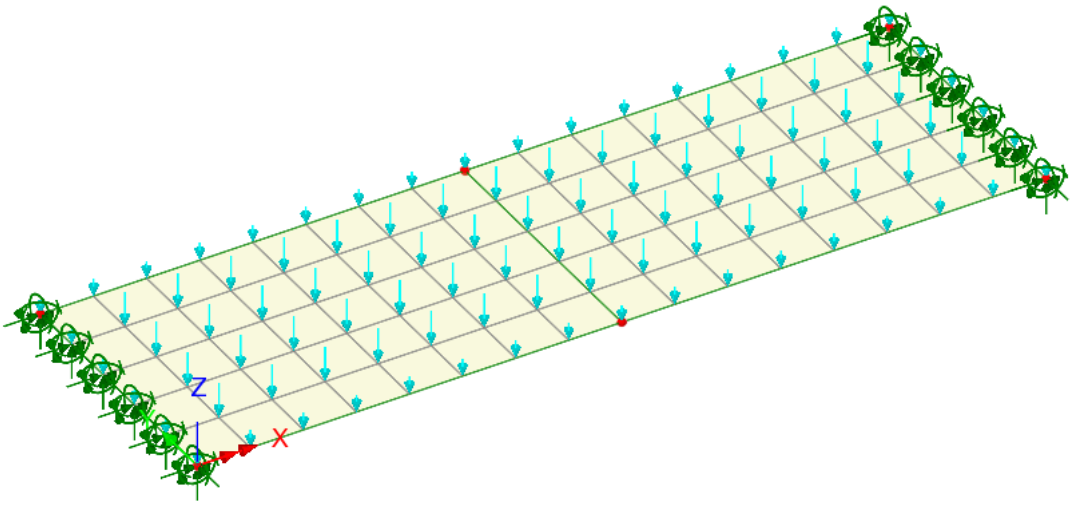

Figure 2 – Structure subjected to uniformly distributed loading.

A hinged connection (i.e., a connection with no rotational stiffness) can be modelled using the *Joint no rotational stiffness* element type, in conjunction with the *On single feature (automatic)* assignment type and the *Joints between surfaces* option, as shown in Figure 3. Assigning the joint mesh attribute to the line shared by the two surfaces generates the joint elements, as illustrated in Figure 4. A joint material attribute must also be assigned to this line. In this example, relatively high stiffness values are specified for the three translational degrees of freedom of the joint elements. This ensures full transfer of shear forces and in-plane membrane forces across the connection. For additional information, refer to: https://www.lusas.com/user_area/instruct/joint_spring_stiffness.html.

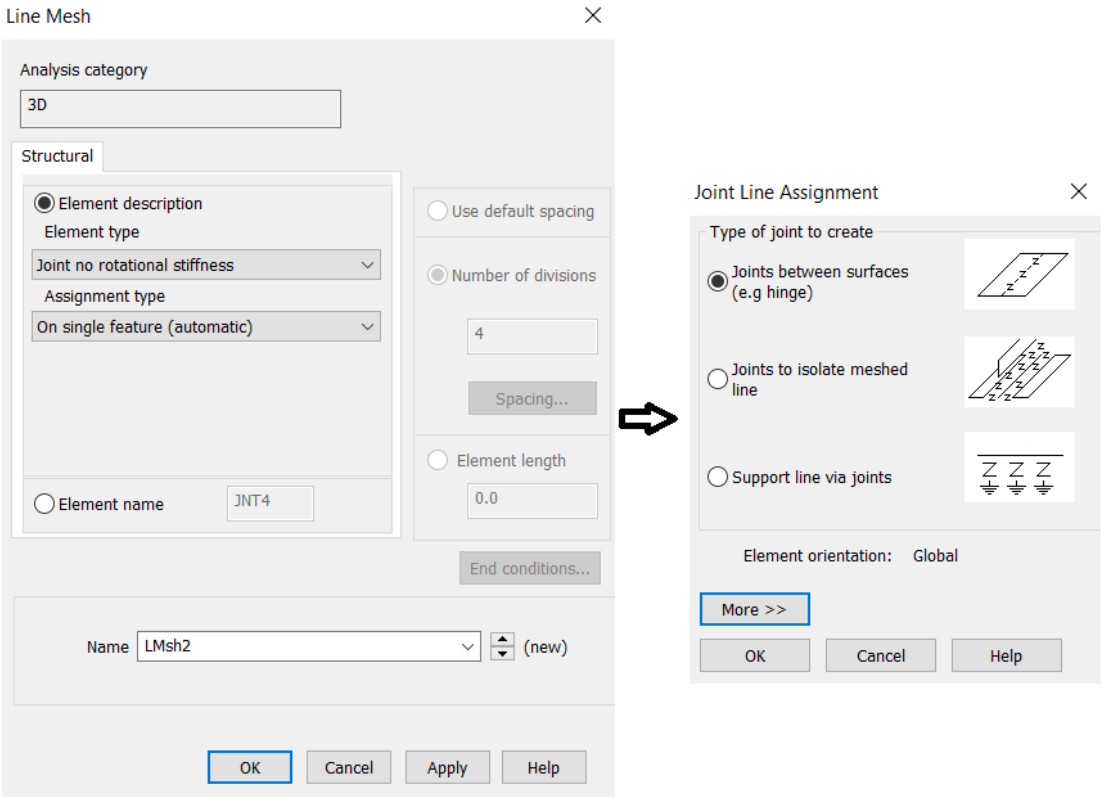

Figure 3 – Joint mesh attribute.

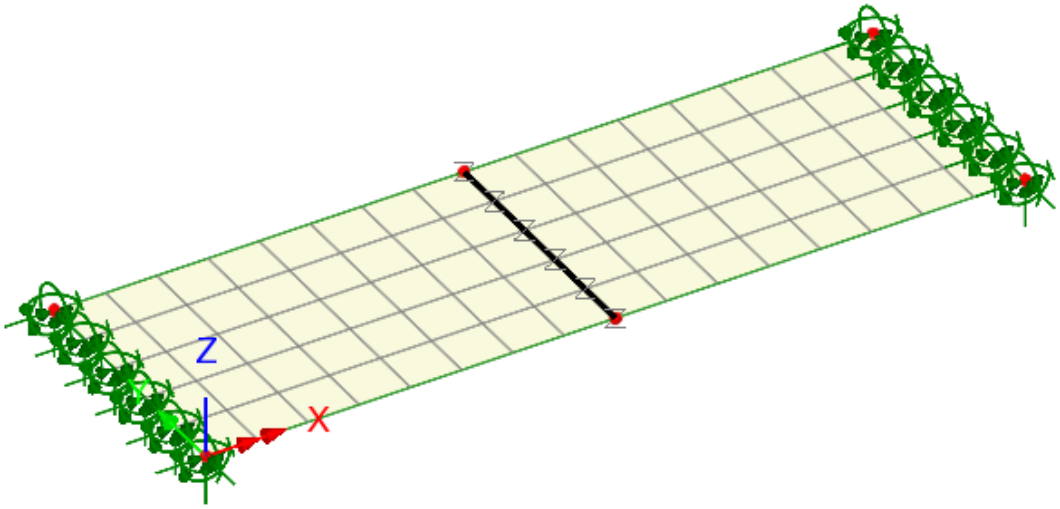

Figure 4 – Joint mesh attribute assigned to line.

The deformed shape of the structure is shown in Figure 5.

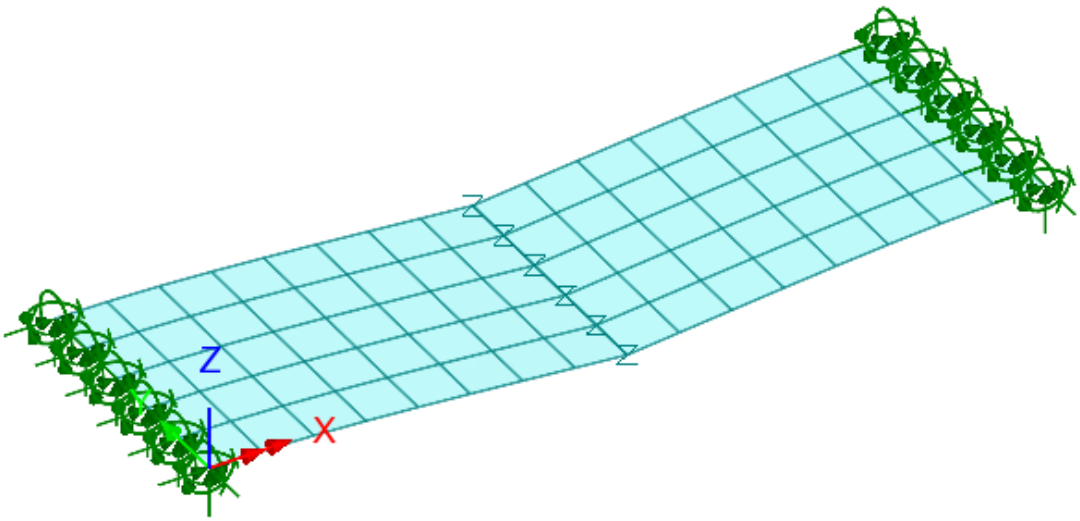

Figure 5 – Deformed shape.

4. Summary

Modelling a hinged connection between two surfaces:

- A hinged connection can be modelled using joints with no rotational stiffness.
- A joint mesh attribute with the assignment type set to *automatic* must be assigned to a single feature (point, line, or surface). Therefore, the automatic assignment type simplifies the modelling of joints and can be particularly useful in cases such as the one considered in this note.
- In this example, the joint attributes (mesh and material) are assigned to the line shared by the two surfaces to model a hinged connection between them.

If you have any doubts or require specific advice for your type of analysis, please contact the LUSAS Technical Support team at support@lusas.com.