CUSTOMER SUPPORT NOTE

# Joints for Modelling a Hinged Connection between Surfaces

| Note Number: | **CSN/LUSAS/1017** |
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This support note is issued as a guideline only.

LUSAS
Forge House, 66 High Street, Kingston upon Thames, Surrey, KT1 1HN, UK
Tel: +44 (0)20 8541 1999 Fax: +44 (0)20 8549 9399
Email: info@lusas.com www.lusas.com

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# 1. Introduction

This support note outlines an approach for modelling a hinged connection between adjacent surfaces. While there are several methods to model such connections, this note focuses on using an automatic joint assignment type introduced in the latest versions of the software. This technical note assumes the reader is familiar with the use of joints in LUSAS.

# 2. Description

A new joint assignment type (see Figure 1) has been introduced in newer versions of the software allowing users to assign joints to a single feature (point, line or surface). The new option automatically creates the required nodes and inserts joint elements at those nodal locations, without the need to unmerge shared geometry. This new option is particularly useful in cases such as the one considered in this note.

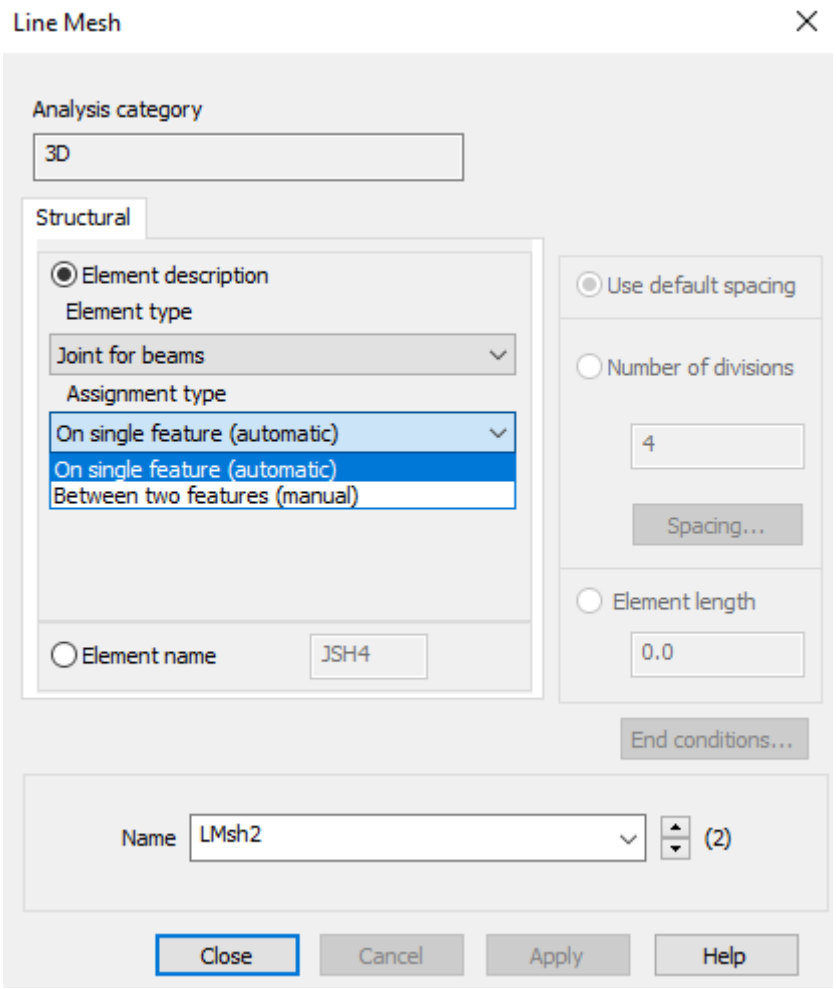


***Figure 1 – Assignment type: On single feature (automatic).***

# 3. Illustrative Example

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

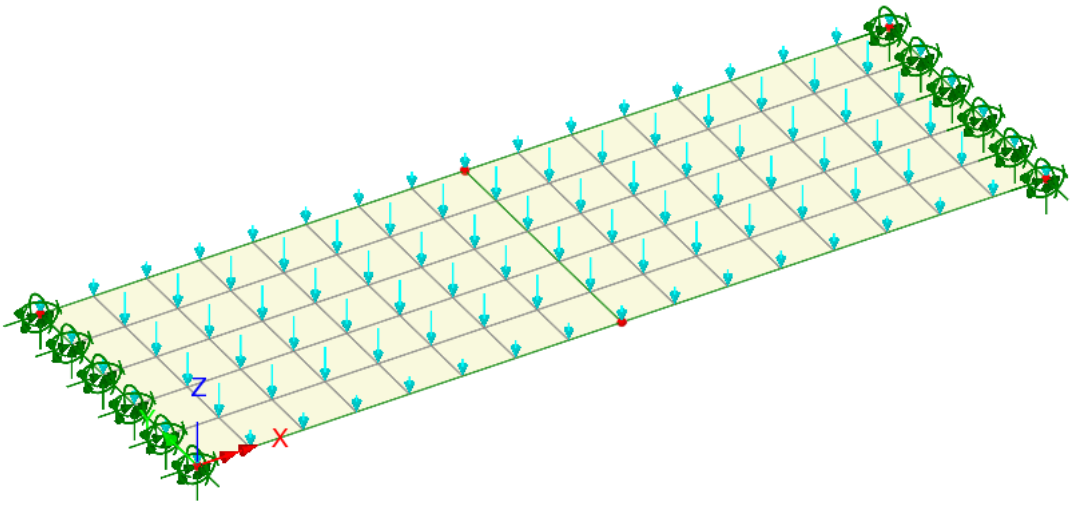


***Figure 2 – Structure subjected to uniformly distributed loading.***

A hinged connection (with no rotational stiffness) can be implemented using the *On single feature (automatic)* assignment type, as shown in Figure 3. In this example, the *Joints between surfaces* option should be selected. The joint mesh attribute is then assigned to the line shared by the two surfaces (see Figure 4). Additionally, a joint material attribute must be assigned to the same line. In this scenario, high stiffness values are applied to all three translational degrees of freedom, relative to the rest of the structure. For additional information, refer to: https://www.lusas.com/user_area/instruct/joint_spring_stiffness.html. This allows full transfer of shear forces and in-plane membrane forces at the connection, whilst releasing moments about the connection line.

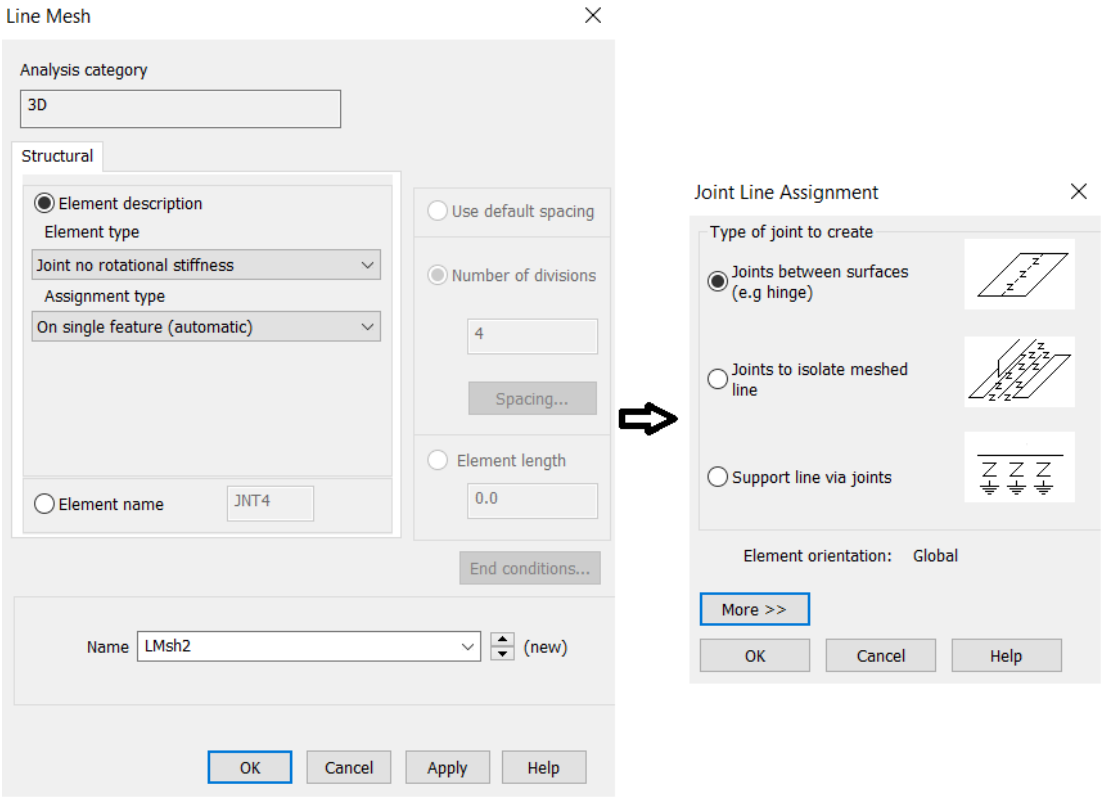


***Figure 3 – Joint mesh attribute.***

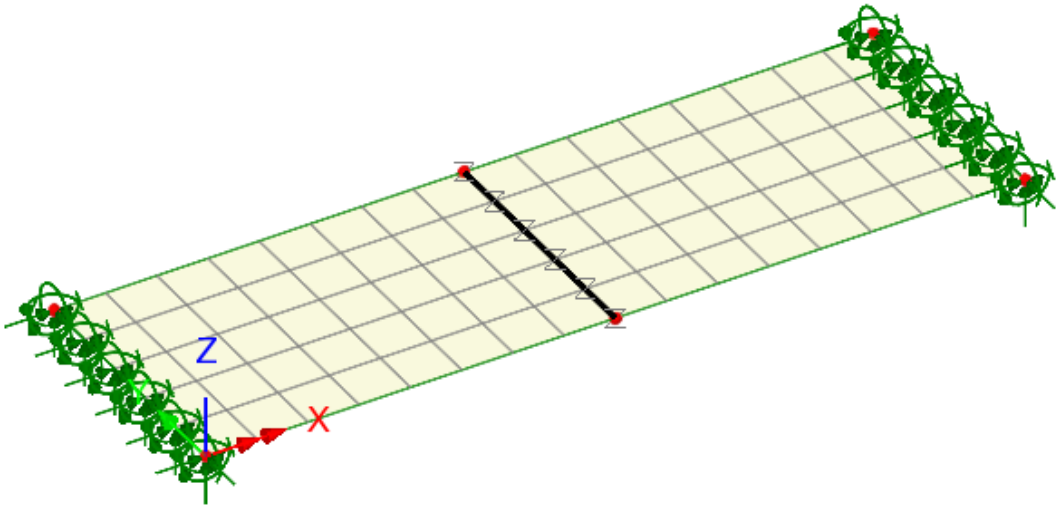


***Figure 4 – Joint mesh attribute assigned to line.***

The deformed shape of the structure is shown in Figure 5. As observed, the hinged connection allows the two surfaces to rotate independently.

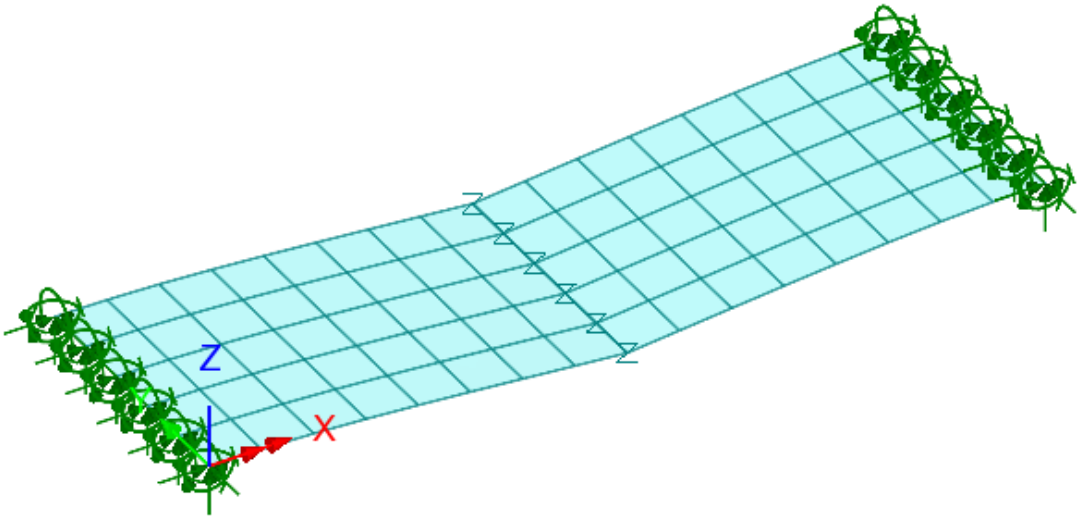


***Figure 5 – Deformed shape.***

## 4. Summary

**Modelling a hinged connection between two surfaces:**

- A hinged connection can be modelled using joints with no rotational stiffness.
- The *On single feature (automatic)* assignment type, introduced in recent versions of the software, allows users to assign joints to a single feature.
- In this example, the joint attributes (mesh and material) are assigned to the line where a hinged connection is required.

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.