

1 MODELLING JOINT FLEXIBILITIES IN BLADED

1.1 Bladed 4.13 and later

Local joint flexibilities can be modelled using the Hinges Feature which allows the user to define 6DOF spring stiffness at each member end, for each member in the multi-member tower. The spring stiffness can be defined based on the Buitrago's equations described in Appendix B of the DNV-OS-J101 standard. It is recommended to define the Hinges in Sesam and export the model to a Bladed project file. Sesam Wind Manager 6.0+ is required to include the hinges data in a jacket structure model. Please refer to the bladed user manual section '11.3 Support structure hinges' for full details on the bladed hinges feature.

1.2 Bladed 4.0 to 4.12

In a standard Bladed multi-member tower, the chord and brace members simply join at the member centrelines (example shown in Fig. 1 for a standard single-brace joint).

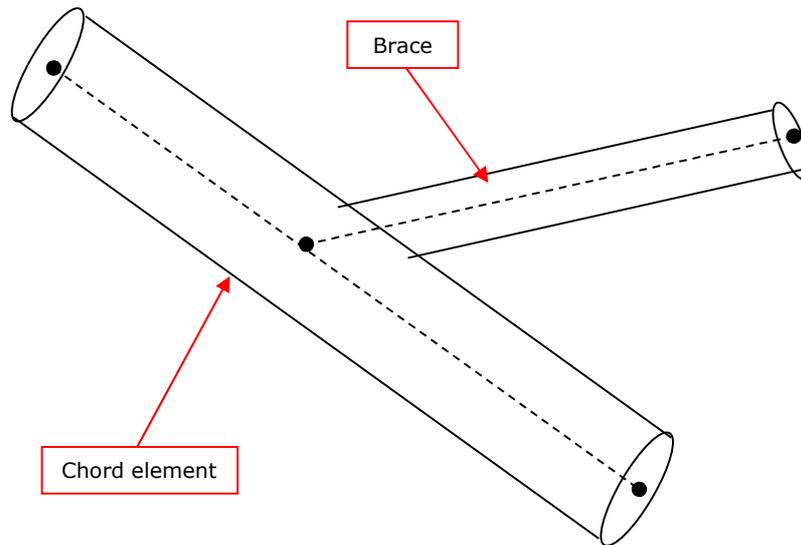


Figure 1: Default configuration of joints in Bladed

To model a flexible joint in Bladed the user must include an additional member extending from the chord beam centreline to the chord beam diameter (Fig. 2). The additional member can be then modelled as rigid and appropriate spring stiffnesses can be modelled at the End node of the member according to user input. If required these stiffnesses can be derived using Buitrago's parametric expressions for local joint flexibilities, which are given in Appendix B of the DNV-OS-J101 standard for single-brace joints, X joints and K joints.

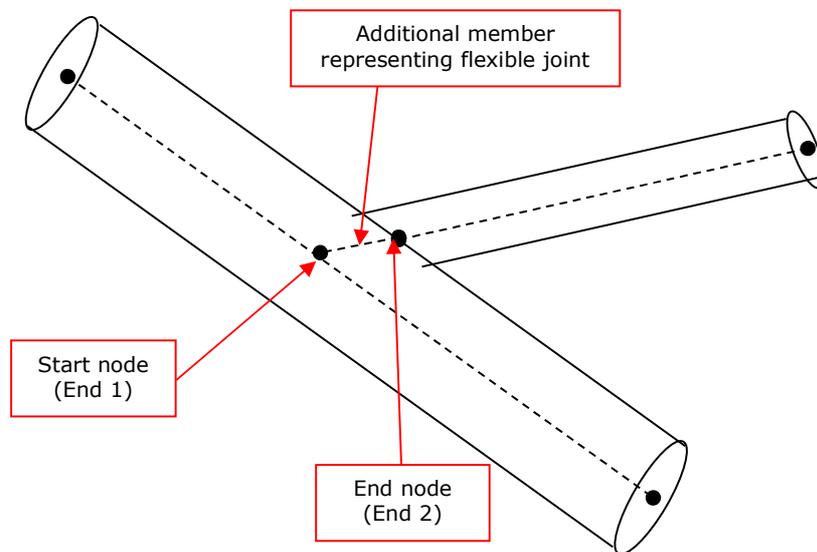


Figure 2: Configuration required for joint flexibility model in Bladed

In that case, the Start node needs to be the End 1 of the additional member representing the flexible joint and the End node needs to be End 2.

Furthermore, the mass of the additional member needs to be input as 0 in the multi-member tower window as this is not a real member of the structure (Bladed does not accept 0 mass values so a very small number can be input). The stiffness assigned to this member in the multi-member tower window is not relevant as it will be overridden by the Local joint flexibilities modelling.

The directional cosines for the additional member will need to be defined so that the z axis is within the plane of the joint.

1.2.1 How to implement

1. Add additional members to the multi-member tower as described above, for all joints to be modelled as flexible
2. Open non-standard options window for dtbladed.exe in the Project Information screen (Fig. 3)
3. Enter code in the format shown in Fig. 3, where
 - NRM = number of flexible joints
 - RIGID = members in the model that represent flexible joints
 - NFJ = number of flexible joints
 - FLEXJOINT = members in the model that represent flexible joints
 - JOINTFLEX = spring stiffnesses (axial, in-plane bending = about y, and out-of-plane bending = about z) for each joint

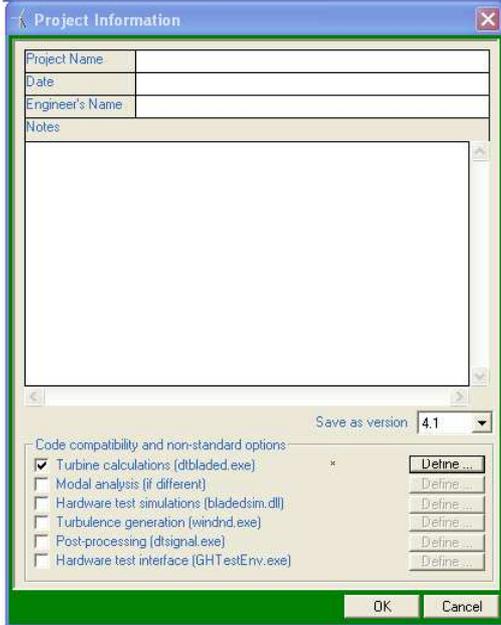
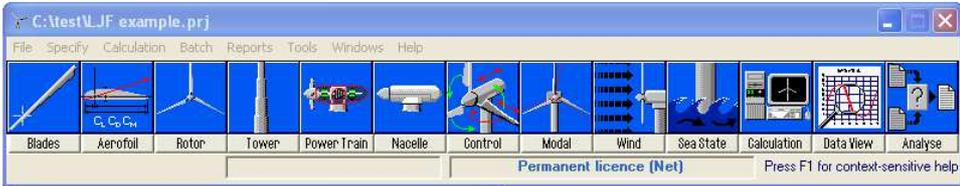


Figure 3: Implementation of local joint flexibilities in Bladed