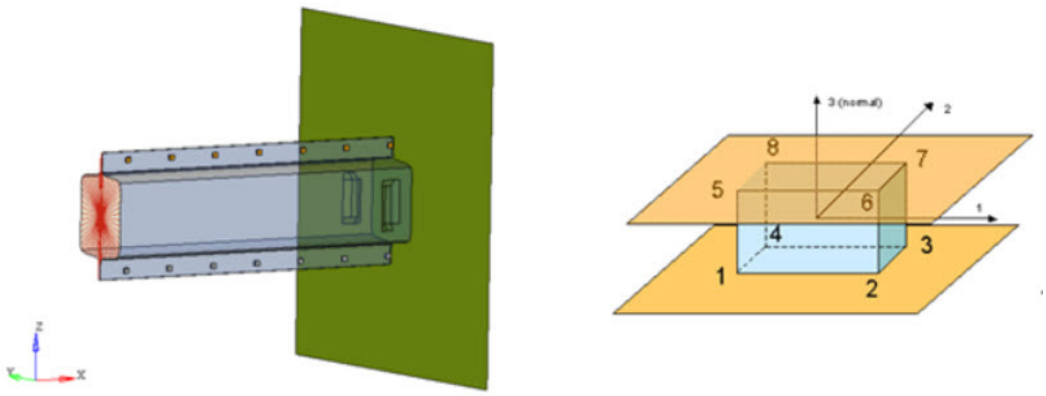
12 Kinematic Conditions

In this chapter the following kinematic conditions will be discussed:

- Tied Contact /INTER/TYPE2
- Rigid Walls /RWALL
- Rigid Bodies /RBODY
- Boundary Conditions /BCS
- Imposed Displacement /IMPDISP
- Type of coordinate system “Icoor”
- Moving, fixed coordinate system /SKEW
- Imposed Velocity /IMPVEL
- Incompatible Kinematic Conditions

Tied Contact /INTER/TYPE2

Tied Contacts define an interface that kinematically connects a set of slave nodes to a master surface. It can be used to connect coarse and fine meshes, model spotwelds, rivets, etc.

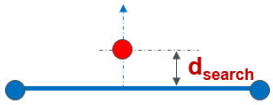


Tied contact interface /INTER/TYPE2 (between solid spotweld and sheet metal)

A tied contact is defined by a group of slave nodes and a master surface. The slave nodes are kinematically tied to the master surface within a defined search tolerance, d_{search}

Warnings are displayed in the starter listing file (_0000.out) if a slave node cannot find a master segment with the search tolerance.

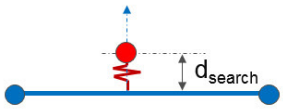
The slave nodes can not be set in any other kinematic constraint otherwise there are incompatible kinematic conditions.



Optional Penalty Method

RADIOSS has an option to define Type 2 interface with the penalty method which removes potential incompatible kinematic conditions with $Spot_{flag}$ = 25

A spring element is defined between the slave node and its projection. The penalty stiffness is constant, calculated as the mean nodal stiffness of master and slave side



Tied Contact /INTER/TYPE2 Formulations

$Spot_{flag}$	Formulation	Usage	Limitation
5	Kinematic	Default	---
1	Kinematic	Optimized for spotwelds or rivets	Mass is added to master surface
20, 21, 22	Kinematic	Formulations with plastic behavior and failure	Kinematic contact until plastic phase
25	Penalty	Save behavior as default usage but with penalty method	Time step can be small

Tied Contact /INTER/TYPE2 Ignore Option

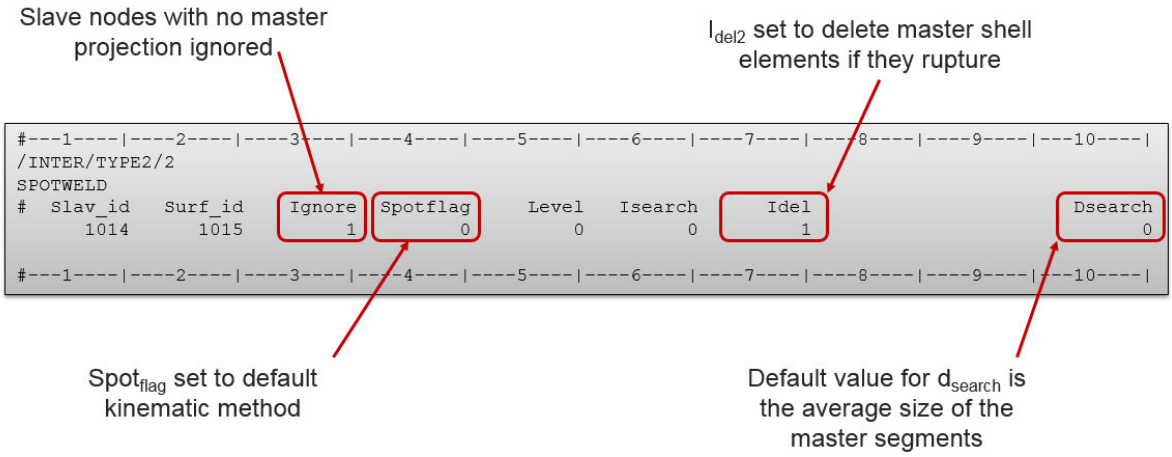
Ignore	Action
0	No deletion of slave nodes (default)
1	Slave nodes with no master segment found during the Starter are deleted from the interface
2,3	Slave nodes with no master segment found during the Starter are deleted from the interface with different methods to define the maximum search distance

The flag Ignore is available to automatically remove all slave nodes which can not be projected on the master surface

I_{del2}	Action
0	No deletion of slave nodes (default)
1	The kinematic condition is suppressed on slave node if the master element is deleted

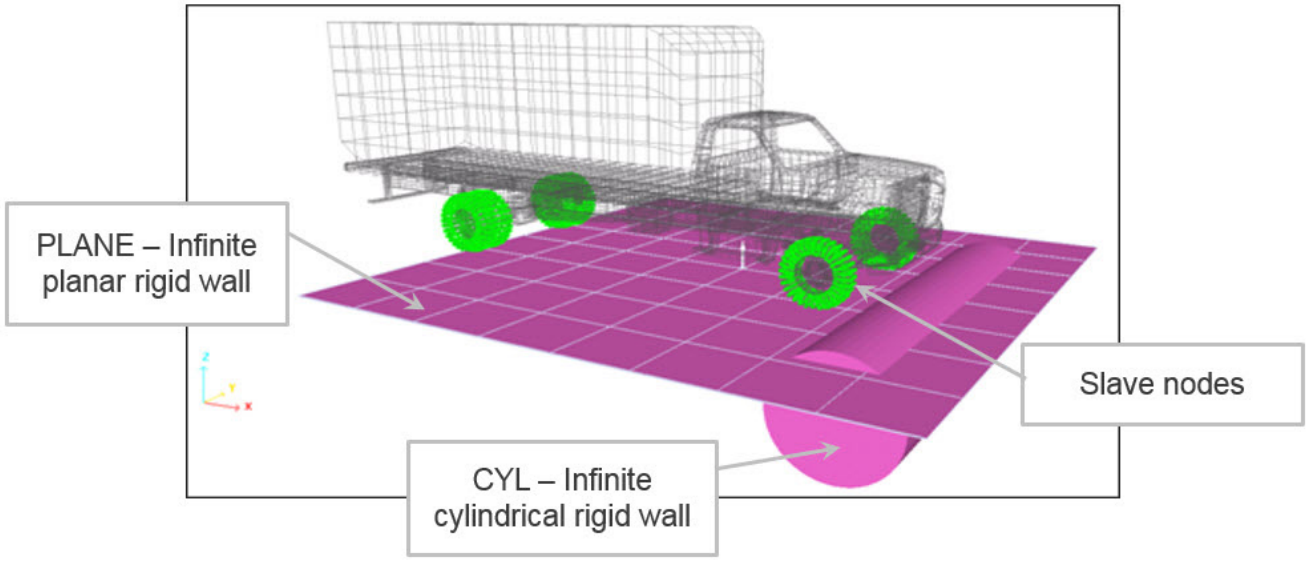
In case failure (rupture of the shell element) is defined on the master side of the interface, it is necessary to update the interface in order to release kinematic condition between the slave node and the deleted element.

Tied Contact /INTER/TYPE2 Card Image



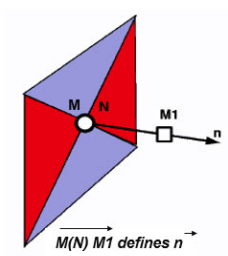
Rigid Walls /RWALL

Rigid Walls allow for an easy way to define an interface between a rigid surface and nodes of a deformable body

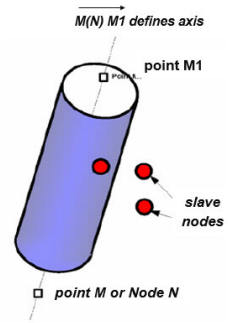


<u>Four types of Rigid Walls are available</u>

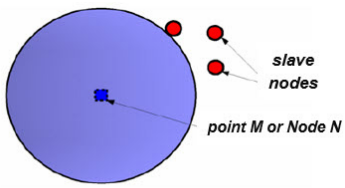
- Infinite plane
- Infinite cylinder of diameter Φ
- Sphere of diameter Φ
- Parallelogram



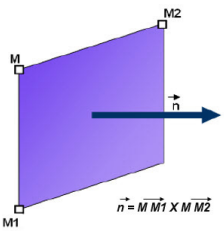
Infinite Plane



Infinite Cylinder



Sphere



Parallelogram