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New in SIMPACK: 2D and 3D General Contact on Flexible Bodies

Up until now, SIMPACK has offered contact modelling as a single–point and multi–point contact approach. The next step was to offer moving contact points on flexible bodies allowing the accuracy of contact models to be further improved, whilst opening the door for SIMPACK into the modelling of highly complicated contact problems e.g. valve trains or gearbox actuators.

The handling of contact problems within MBS programs is invariably demanding on the solver numerics, stability and the accuracy of the simulation. Besides specific geometric surface contact problems (i.e. circle-circle, line-circle, gearwheels, …) which can be solved directly, there have to be solutions for general arbitrary shaped geometric contact problems. You can find two approaches in SIMPACK 8.6 for this kind of simulation:

1. Intersection Method: This approach calculates contact forces from the intersecting geometry areas, which can intersect at more than one point allowing multi-point contacts.
2. Moved Marker Method: This approach with only single point contact uses Moved Markers to determine the potential contact point. Each of the contacting surfaces has a Moved Marker located on the surface whose motions are coupled together via a placement constraint.

Due to more demands on accuracy and model detail it has become necessary to be able to define the contact bodies as flexible. This means the contact forces which move over the body act on a flexible body - providing another challenge for the contact modelling. The problem was solved up until now by stiffening the contact region on the flexible body so that the resulting contact forces and moments could be applied at a single node. This approach is acceptable as long as the length of the potential surface contact region is sufficiently small in relation to the total length of the flexible body.

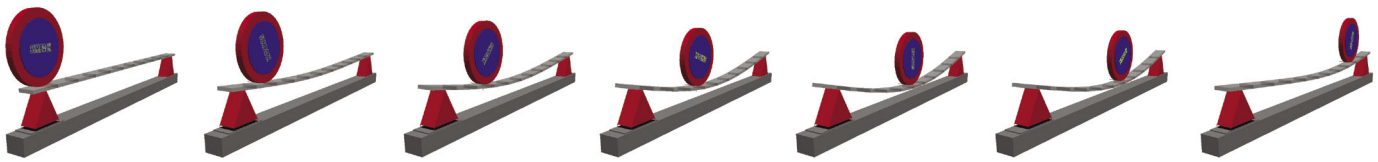
To allow long (in comparison to the total length of the flexible body) potential contact regions to be modelled, a new modelling approach in SIMPACK has been developed for '2D curve on 2D curve' and for '2D curve on 3D surface'.

NEW DEVELOPMENT - 2D CURVE ON 2D CURVE CONTACT ON FLEXIBLE BODY

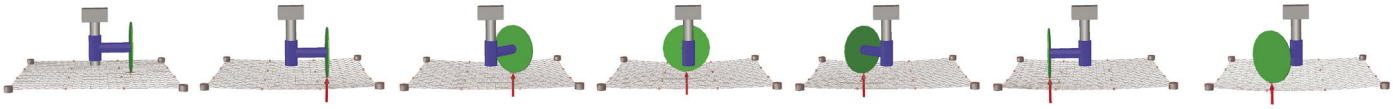
This new flexible body contact approach no longer uses the stiffening of the potential contact region. The contact force is not applied as a resulting force or moment at the reference point of the stiffened region, but directly at the position of the moving contact point. This means that the shape of the contact surface is changed continually due to the deformation of the elastic body. It is now necessary to describe the surface not through an external surface file (.su2 or .su3 file), but directly from the flexible body nodes in the potential contact region. The calculated forces are applied directly to the nodes surrounding the contact region. This makes it necessary to continually update the spline calculation of the surface during the simulation, as the FE nodes move as the force is applied.

NEW DEVELOPMENT - 2D CURVE ON 3D SURFACE CONTACT ON FLEXIBLE BODY

In addition to the '2D curve on 2D' curve contact, SIMPACK offers '2D curve on 3D surface contact' with the 3D surface also defined directly via the flexible body nodes. The flexible deformation of the body, due to the contact forces, is taken into account during the simulation using a 3D online spline calculation.



Example for 2D Curve Contact



Example for 3D Curve Contact