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KISSsys instruction for Modeling bearing between two shafts

1 Description

1.1 Task

This document and the related KISSsys model „206-Pilot-bearing.ks“ describes how it is possible to model a common arrangement of the shafts for vehicle transmission where a bearing is supported between two shafts. This bearing will be called later “pilot bearing”.
Because of the large variation of the designs all special things cannot be described here. In case if you need some more instructions, please contact KISSsoft AG and ask for KISSsys support.

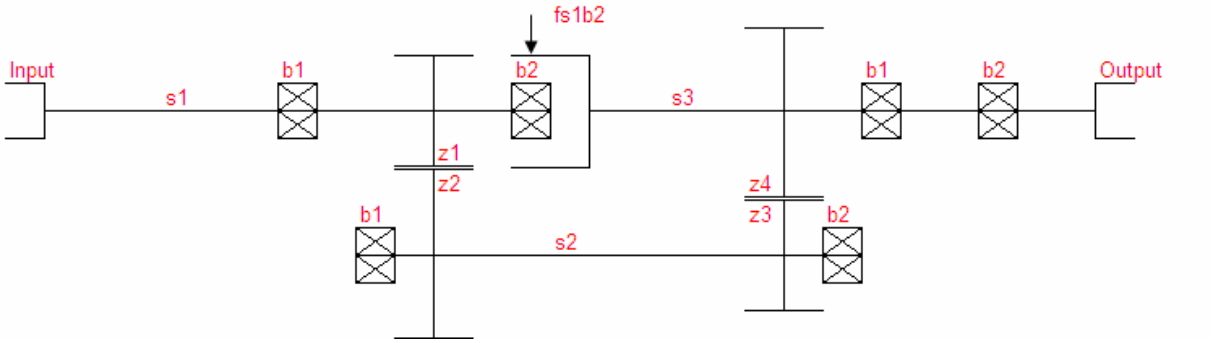

Figure 1.1-1 Schematic of the example model

The pilot bearing “b2” is not supported to the housing, but is between shafts “s1” and “s3”, so that inner ring is in the shaft “s1” and outer ring in the shafts “s3” or vice verse. Other bearings are supported to the housing. The pilot bearing “b2” and the force “fs1b2” will be connected, so that bearing forces (Fx, Fy and Fz) are linked to the force as well as the position of the bearings. Also deflection values for the force are taken then back to the bearing.

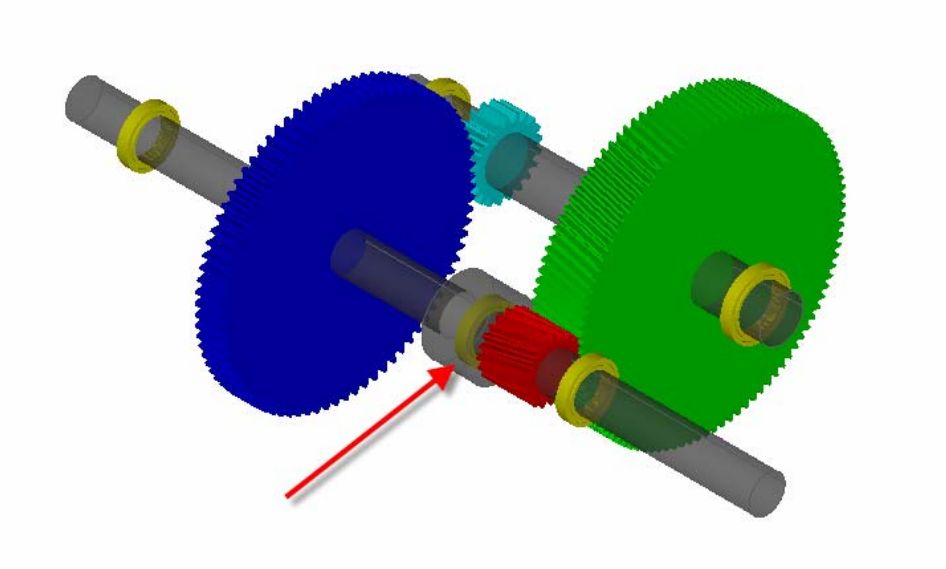

Figure 1.1-2 The pilot bearing position between two shafts

2 Building up a model

2.1 Create a model

Start to build up model as any KISSsys model. Plan your model first and then start with adding first "kSysGroup". Add all needed machine components. Model the pilot bearing to the shaft that is supported only with one bearing in the housing. Add also extra force component to make interaction or connection between the shafts "s1" and "s3".

2.2 Model specialties

There is needed to be created a connection between the pilot bearing and the force "fs1b2". From the bearing we move the bearing forces acting on the shaft "s3" to the related forces and from the forces we take back, to the pilot bearing, the deflection values of the shaft. This creates connection between shafts. The pilot bearing is considered as hinge, where bending moment is zero.

2.2.1 Creating force connections

Open the properties window of the force component "fs1b2" to create connection to bearing forces. Define "Fx", "Fy" and "Fz" components. These components should be now equal to the pilot bearing forces "b2" and can be therefore directly taken from the bearing.

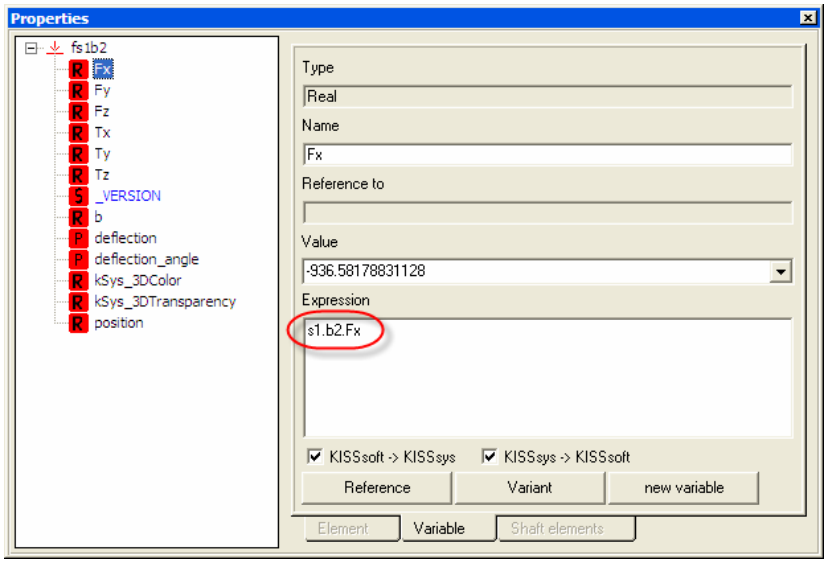

Figure 2.2-1 Connecting force and pilot bearing

Variable	Expression
Fx	s1.b2.Fx
Fy	s1.b2.Fy
Fz	s1.b2.Fz

Note! When using different names to the example file replace red names “s1.b2” with your own names.

2.2.2 Creating deflection connection

Open the properties window of the pilot bearing “s1.b2” to add deflection values for the bearing position to be equal with the other shaft “s3” at the same place. Connect “ux” and “uz” to deflection values of the force “fs1b2” in x and z directions.

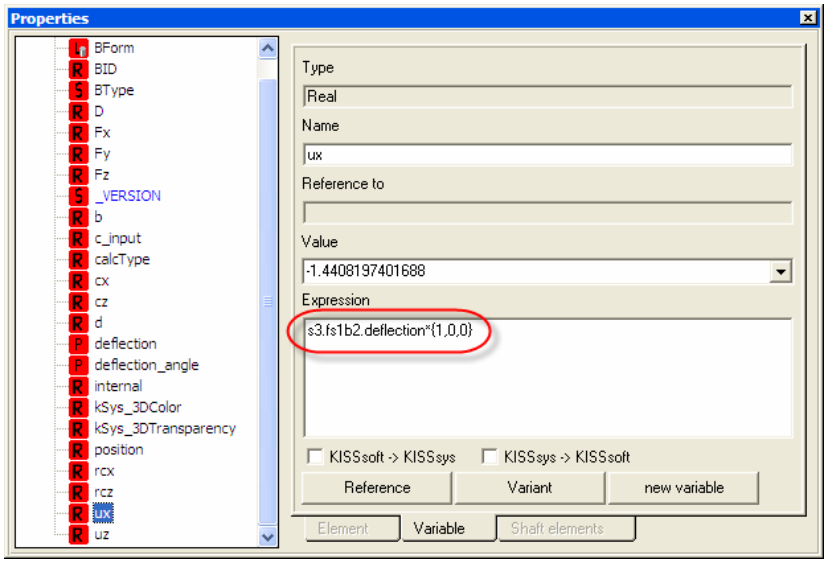

Figure 2.2-2 Deflections in pilot bearing

Variable	Expression
ux	s3.fs1b2.deflection*{1,0,0}
uz	s3.fs1b2.deflection*{0,0,1}

Note! When using different names to the example file replace red names “s1.fs1b2” with your own names.

2.2.3 Positioning the force

Because the pilot bearing “b2” and the corresponding force “fs1b2” needs to be on the same position in the space, we can create an expression for the force position, so that it will always be positioned according to the bearing. This can be done under “Properties”- “position” of the force “fs1b2”.

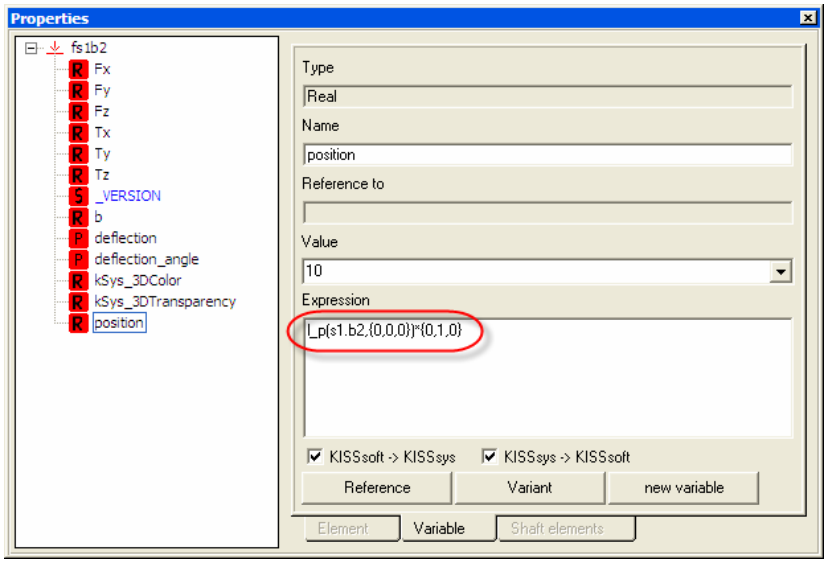

Figure 2.2-3 Position of the force

Using the function “l_p(reference,{point})*{0,1,0}” it is possible to transform the local co-ordinate of the “reference” component to the local coordinate of the parent component of the current component. So taking the local co-ordinate of the “b2” on the shaft “s1” and transforms it to the local coordinates to of the “fs1b2” on the shaft “s3”. And finally multiplication with {0,1,0}takes only the y-component.

2.3 Calculating the pilot bearing

When adding calculation to the pilot bearing it can be added directly under the bearing.

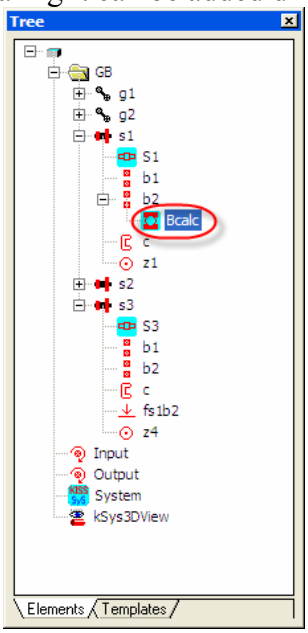

Figure 2.3-1 Adding the pilot bearing calculation

Then default speed definition for the bearing needs to be changed to be the relative speed between the shafts. Do the under the calculation module properties and define new expression for the speed “n”. Delete default expression and type in formula to take absolute speed difference between “s1” and “s3”.

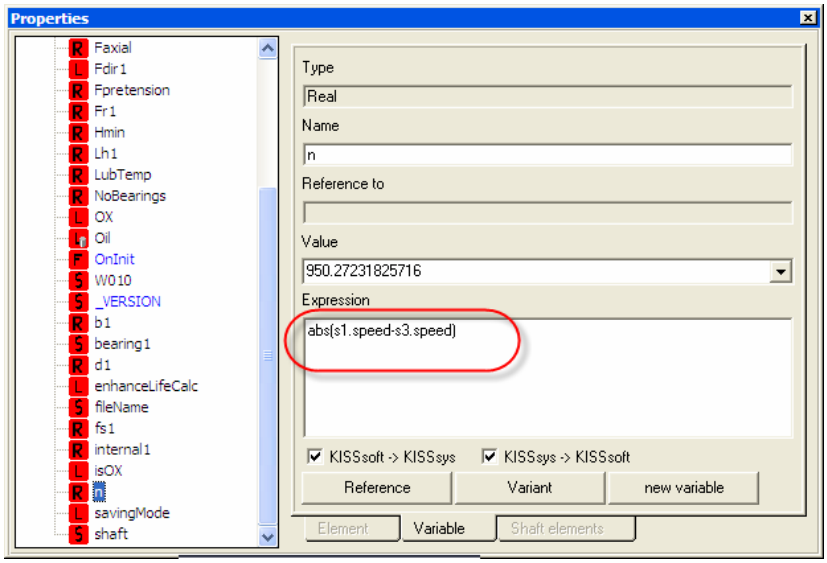

Figure 2.3-2 Definition of the pilot bearing speed

2.4 Kinematics Iteration

As the bearing forces are in this case affecting deflection of the shaft and the deflection of the shaft in return is affecting the bearing forces, iterations have to be made when calculating the correct forces. These iterations are not activated per default.

To activate iterations, right click on "System" and choose "Properties". Check the variable "kSysKinematicFunc". Select from the list the functionality "call 'OnCalcTorque' during calculation of torque" and quit the window.

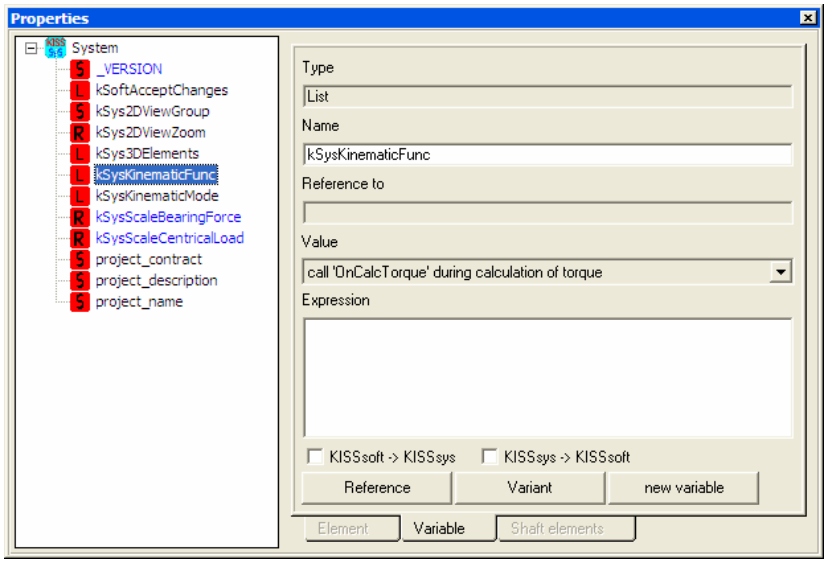

Figure 2.4-1 Setting the kinematic iteration

Be informed that you see the iteration steps now in the message bar in the lower section of the KISSsys window when you are calculating kinematics and that the calculation itself takes longer.

It is also possible to use "SpecialTemplates.ks" created for creating a "bearing-force" connection automatically. See more detailed information about this from instructions "ins-303-Bearing-force-connection.pdf"