

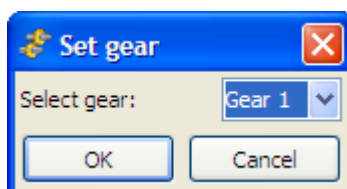
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## Table for power flow variations

This paper describes a new table based approach for variable power flow selections in a model. This is useful for example in vehicle applications, where it is possible to select different speeds (gears) for power flow.

User doesn't need to think about difficult programming for gear and clutch configuration changes anymore when power flow is changed. Provided functionality describes open and closed connections for selected gear or clutch connections or connection elements in a single table. User only needs then to define which connections are activated with different power flows.

Speed	_O.GB.Side.c1.Spe	_O.GB.Side.c2.Spe	_O.GB.Side.c3.Spe	_O.GB.Side.c4.Spe	_O.GB.Main.cr.Spe
1 Gear 1	1	0	0	0	0
2 Gear 2	0	1	0	0	0
3 Gear 3	0	0	1	0	0
4 Gear 4	0	0	0	1	0
5 Gear R	0	0	0	0	1



Configuration	Clutch			
	A	B	C	D
Forward 1	x		x	
Forward 2	x			x
Forward 3		x	x	
Forward 4		x		x
Reverse 1	x	x	x	
Reverse 2	x	x		x

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## 1 The idea of the table

The idea of the table is to make it easy to consider different types of connections between clutches, gears and other components. Users may normally define a table for different speed possibilities in the gear box presented in a table e.g. as follows.

Configuration	Clutch			
Speed	A	B	C	D
Forward 1	x		x	
Forward 2	x			x
Forward 3		x	x	
Forward 4		x		x
Reverse 1	x	x	x	
Reverse 2	x	x		x

Figure 2.1-1 Speed definitions in a table

To program all of these combinations in a KISSsys model, required user defined (sometimes very complex) functionality to set connection configurations for every different case. This table allows user to set up similar type of table, as seen in picture above, to let program automatically set correct connections active.

## 2 Table implementation

### 2.1 Load template and paste table

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The table is not available in the default templates, but can be downloaded from the KISSsoft homepage form download section for KISSsys. The template is called “305-SpeedTable.ks”.

Finalize your model kinematics before adding the table, because it will automatically look for all suitable connections form the model. Insert the table to the tree structure with desired name (Administrator mode needs to be activated). When the table is pasted to the model, it will automatically open a dialog to make configuration selections.

### 2.2 Definition

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The following definition is automatically run when the table is inserted. It is possible to change whole definition afterwards by manually executing function “Setup” under the table (Administrator mode

needs to be activated). Note in this case previous definitions maybe deleted. Normally table definitions should be done only once and this function is not needed to be run again. If user wants to change configurations (remove or add connections) to be considered, this function can be executed again.

1. Define the number of different power flows in the model.
2. Define if coupling connections are considered. Activated or opened with different power flows
3. Define if gear connections are considered. Activated or opened with different power flows
4. Define if general bearing connections (between two shafts) are considered. Torque activated or inactivated with different power flows

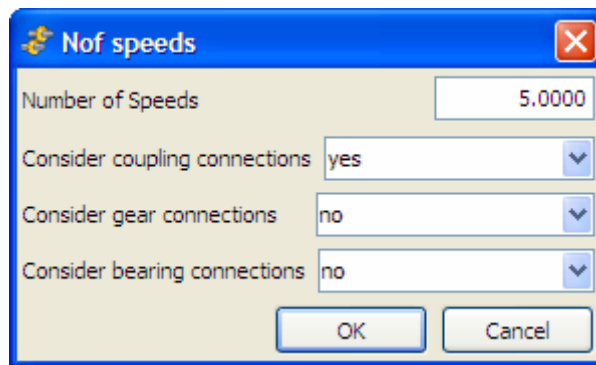


Figure 2.2-1 Define number of different power flow possibilities and connections to be considered

After this a definition dialog for each clutch connection, gear connection and connection bearing is shown to make selection for connection type if these should be considered. User can then select how the connection is to be handled when power flow is changed.

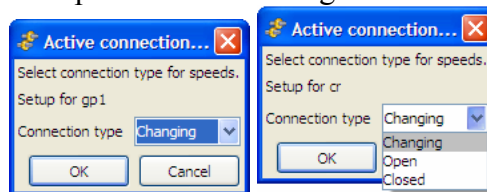


Figure 2.2-2 User can select how the connection should be handled

For each connection there are three possibilities available.

<b>Changing</b>	Select this type if connection can be open or closed depending on the power flow selection
<b>Open</b>	Connection is always open
<b>Closed</b>	Connection is always closed

When a clutch connection is selected to be changeable, configuration can be changed with the power flow. If gear connection is selected to be changeable, activation can be changed with the power flow. If connection bearing is selected to be changeable, “torque” activation can be changed with the power flow.

## 2.3 The table

After the definition of all the connection types a table of changing connections is shown to make configuration for power flows. A new variable type “Array” is created for these connections and activation per speed selection is saved in this variable.

	Speed	_0.DC.Syncro1.S	_0.DC.Syncro2.S	_0.DC.Syncro3.S	_0.DC.Syncro4.S	_0.DC.Syncro5.S	_0.DC.Syncro6.S	_0.DC.SyncroR.S	_0.DC.Gear1.Set
0	x	0	0	0	0	0	0	0	0
1	x	0	0	0	0	0	0	0	0
2	x	0	0	0	0	0	0	0	0
3	x	0	0	0	0	0	0	0	0
4	x	0	0	0	0	0	0	0	0
5	x	0	0	0	0	0	0	0	0
6	x	0	0	0	0	0	0	0	0

Figure 2.3-1 An empty table after the initial configuration

## 2.4 Definitions

User can type in desired names for power flow selections in the first column. This field is text type field and therefore names for speed or connections can be freely selected. The rest of the columns are defining which of the connections are activated with each power flow configuration. When value is set to 0 connection is open and when value is 1 connection is closed.

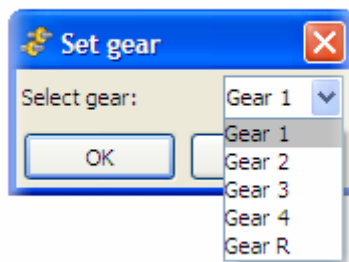
	Speed	_0.DC.Syncro1.S	_0.DC.Syncro2.S	_0.DC.Syncro3.S	_0.DC.Syncro4.S	_0.DC.Syncro5.S	_0.DC.Syncro6.S	_0.DC.SyncroR.S	_0.DC.Gear1.Set
0	Gear1	1	0	0	0	0	0	0	1
1	Gear2	0	1	0	0	0	0	0	1
2	Gear3	0	0	1	0	0	0	0	1
3	Gear4	0	0	0	1	0	0	0	1
4	Gear5	0	0	0	0	1	0	0	1
5	Gear6	0	0	0	0	0	1	0	1
6	GearR	0	0	0	0	0	0	1	1

Figure 2.4-1 The table filled with correct connections activations per each speed selection

## 3 Calculations

### 3.1 "SelectGear"

Function "SelectGear" makes the gear selection. Dialog for gear selection is shown.



This function will only select gear from the list and sets the correct configuration for each connection on. The function doesn't run the kinematic calculation, so it needs to be executed separately to consider new power low. Remember to run therefore both functions!

## 4 Remarks

There are three different ways to set up active connections between gears. User can select one of the connection types to be considered in the model. This means that per one gear pair only one of the followings is needed and kinematic calculation can be run when configurations are made correctly.

- User may consider gear connection to be activated or inactivated. This can be used if it not important to know or calculate in details any elements between the loose gear and the supporting shaft.

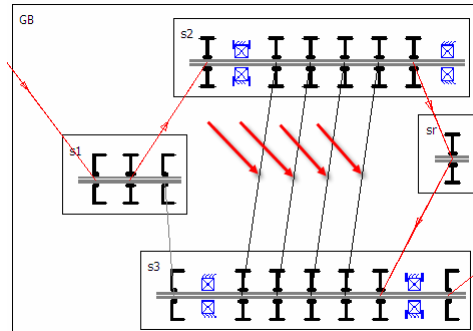


Figure 3.1-1 Only gear connections activated when not interested in detail what happens between gear and shaft

- User may consider clutch connection between loose gear and the supporting shaft (e.g. as synchronizer). In this case it is possible to calculate also bearings or other components between the elements

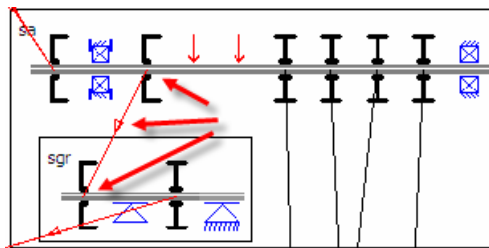


Figure 3.1-2 Loose gear connection with clutch connection, bearing - force pair needed to consider gear forces in the supporting shaft

- Connection bearing can be considered as “synchronizer” in case if model is built using the coaxial shaft elements. In this case no external clutch connection between loose gear and supporting shaft is needed, but the connection is considered using the connection bearing element. (general connection between two shafts “kSysConnectionBearing”)

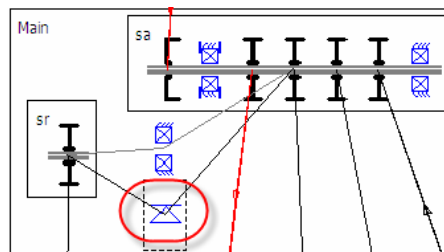


Figure 3.1-3 Connection element between coaxial shaft used to activate gear connection