



# 20-sim Newsletter

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## Precisiebeurs

Controllab will present the latest news on 20-sim and 20-sim 4C at the [Precisiebeurs](#) tradefair in Veldhoven.



The tradefair will be held on Wednesday 1 and Thursday 2 December at NH Conference Centre Koningshof.

### 20-sim 4C

We will show version 2.0 of 20-sim 4C.

- New target: Bachmann M1.
- Sneak Preview: Wireless Operator Interface using I-pad and smart phones.

### 20-sim

A preview will be given of a new 20-sim toolbox: *Dynamic Error Budgeting*.

### 20-sim 4C 2.0

20-sim 4C 2.0 is almost ready. The beta version will be released after the Precisiebeurs. The release is planned for the start of 2011. The new version has some exiting improvements and extensions.

### Bachmann M1

In cooperation with [Bachmann](#) a new target has been added to 20-sim 4C.

# bachmann.

In 20-sim 4C 2.0 you can export models to the Bachmann M1 controller. Using the standard interface of 20-sim 4C, you can load models, start them and stop

them and do measurements. No external software is needed and knowledge of programming is not required!

### Monitoring and Logging

The monitoring speed has been improved. You can now view variables with speeds up to 200 Hz. Logging can now be performed interactively. You can abort logging and monitor the results during a run.

### Connecting

Connecting to targets has been improved. You can now connect to targets, without being forced to shutdown the wireless network connection.

### User Interface

The 20-sim 4C user interface has been updated. You can change parameters before a run. The model hierarchy is now displayed by graphical icons.

### 20-sim 4.1.2.4

A new build of 20-sim has been released. This build has some new features and several bug fixes.

### Features

- Support for 20-sim 4C 2.0.
- Menu of additional simulator plots extended.

### Fixes

Many small errors and bugs have been solved. The most important are listed below:

- Better handling of values that become Inf or Nan.
- Multiple threading with new Matlab version.

### Registered Customers

Everyone with a valid license of 20-sim 4.1 can upgrade to the new build.

- Download 20-sim 4.1.2.4 from the 20-sim website.
- Install the package.
- During the installation you will be asked to upgrade your version of 20-sim. Choose yes.

## Case: How to model bodies connected by a bearing?

### Problem Description

An axis (*body 2*) is mounted on a floating frame (*body1*) with two bearings. The bearings are mounted with a distance  $w$  in between. Both bearings have an offset to the center of mass of both the axis and the frame. How can we model this in 20-sim?

### Sketch

We start by making a sketch of the system (see figure 1). The bearings are represented by springs in the x-direction and y-direction. A two-dimensional model with a small rotation around the z-axis will therefore be sufficient to model this system. The 20-sim *2DSmallRotation* library is suited for these type of systems.

### 2DSpring

Any mounting that is represented by springs can be modeled using the *TwoDSpring* model. A sketch of this model is shown in figure 2. The *TwoDSpring* model has a spring in the x-direction, y-direction and a rotational spring around the z-axis. The corresponding spring stiffnesses are  $k_x$ ,  $k_y$  and  $k_\theta$ . In figure 2, the springs in x-direction and y-direction are cut into halves for visual clarity.

The springs of the *TwoDSpring* model are centered in the middle, indicated by the center coordinate frame (blue). The offset of this frame with respect to both bodies is indicated by the coordinates  $x_1$ ,  $y_1$ ,  $x_2$  and  $y_2$ . Note that the offsets are given with respect to the center coordinate frame. In the sketch above this means that  $x_1$  and  $y_1$  have negative values and  $x_2$  and  $y_2$  have positive values.

### Model

To complete our model we have to convert the parameters of our system to the parameters of the *2DSpring* model. The *2DSpring*

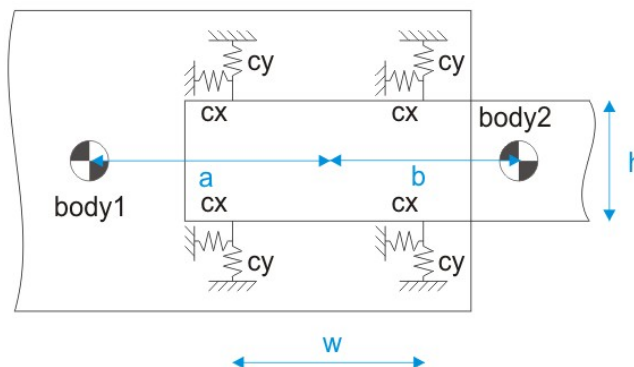


Figure 1: Sketch of two bodies interconnected by two bearings.

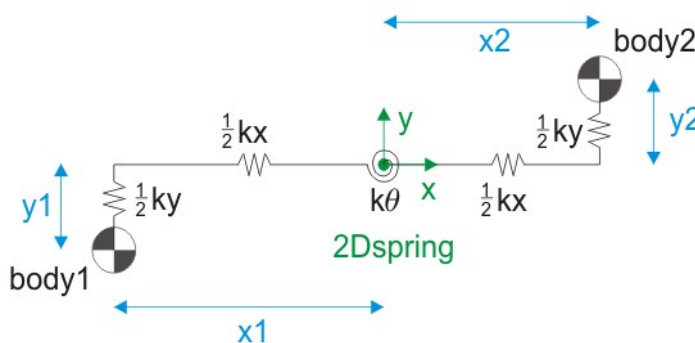


Figure 2: The *TwoDSpring* model.

model has a center position. This center position is equal to the center of rotation when both bodies are applied with a torque. For the given system this center of rotation is in the middle of the springs. The resulting stiffness values can be calculated as:

$$k_x = 4 \cdot c_x$$

$$k_y = 4 \cdot c_y$$

$$k_\theta = 4 \cdot c_x \cdot \left(\frac{h}{2}\right)^2 + 4 \cdot c_y \cdot \left(\frac{w}{2}\right)^2$$

The rotational stiffness is found by multiplying each translational spring by its lever ratio squared and then summing them up.

There are no offsets in the y-direction, so  $y_1$  and  $y_2$  are equal to zero. For the offsets in the x-direction, we have to take into account that all offsets are defined with respect to the center of the spring.

$$x_1 = -a$$

$$y_1 = 0$$

$$x_2 = b$$

$$y_2 = 0$$

The resulting 20-sim model is shown in figure 3. To speed up simulation, the *TwoDSpring* can be added a little damping. Each *TwoDSpring* model has a damping implemented parallel to the springs in x-direction, y-direction and rotation. Since damping values for real mechanical systems are seldom known, a good starting value is to make the damping 0.1% or 1% of the corresponding spring values.

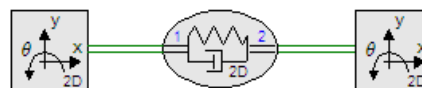


Figure 3: Resulting 20-sim model.



## New members of the 20-sim team

### Hiwot Differ



My name is Hiwot G.Differ and I am from Ethiopia. I studied Electrical Engineering and received a masters degree in Control

Engineering at the University of Twente with cumlaude. During my thesis, I had the opportunity to work on physical modelling and practical realization with 20sim and 20sim 4C. So when I was offered a position in controllab products where I get the chance to experience industrial applications of my study, I gladly accepted. I am presently working on design of a thermoslab setup and a mobile webpage application for monitoring 20sim 4C enabled targets.

### Maarten Meijer



Hello, my name is Maarten Meijer. Currently, I am studying Elektrical Engineering at the University of Twente. At the study Electrical Engineering, it is usual to finish the Bachelor's phase

with an individual research assignment. For me, it became possible to investigate the connection of Simulink with 20-sim 4C at Controllab, which was a nice and challenging assignment. After a successful completion thereof, I got the opportunity to keep working at Controllab on part-time basis, an opportunity which I would not resist. Currently, I am, among others, occupied with the design of an actual software implementation of this connection between Simulink and 20-sim 4C.

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