CAMPaM Introduction

- **Who am I**
- **What is FMTC**
- **My interest (Modeltransformations, User interfaces, Synthesis drive-components)**
- **What I hope to achieve from this workshop**
- **What I can bring to this workshop**

Who am I

- Edward Hage - 1972
- Studied Mechanical Engineering '93-'97 in Twente (Master), the Netherlands
- More than 10 years in Mechatronics, worked for ASML and had my own company Confirmat
- Now employed (since december 2008) in Belgium at FMTC, Leuven.

What is FMTC

FMTC = Flanders' Mechatronics Technology Center

About 30 people staff, intent to double in size in next 5 year

FMTC is funded primarily by Flanders' (=Belgium) government to bridge the gap between academics and Mechatronics Industry in Flanders.

Top-competences:

1) **Machine servitization (datamining etc.)**
2) **Modular machines (safety, wireless sensors)**
3) **Energy-efficient drives**

My interest

As part of energy-efficient drives we need to understand the system, we model this (Modelica, also evaluating SimScape).

I am project-member of:

“Mechatronic co-design for productivity and energy-efficiency”

In this project I am examining acausal systemdescription as a means to model physical (mechatronic) systems.

I want to explore means and methods to perform model-transformations, create user interfaces for engineers, and synthesis of drive-components and looking for participants for co-operation (next year).

Model transformations (1)

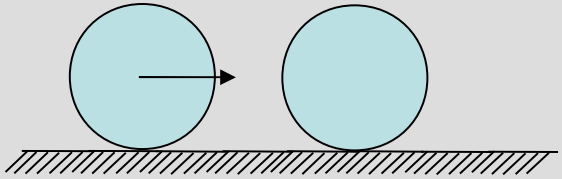
My scope on modeltransformations:

- **From a useful userfriendly physical representation what the engineer understands to Modelica-model**

(which does not need to be so userfriendy because you do not 'see' it).

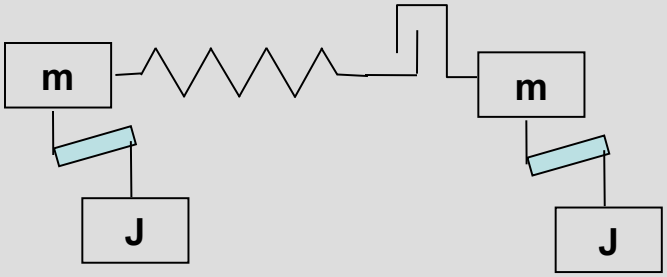
- **Modelica- to Modelica-models**

Very simple example:

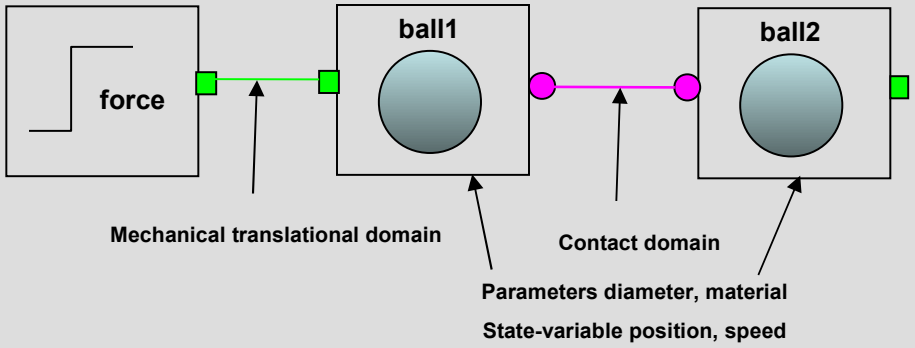


Model transformation (2)

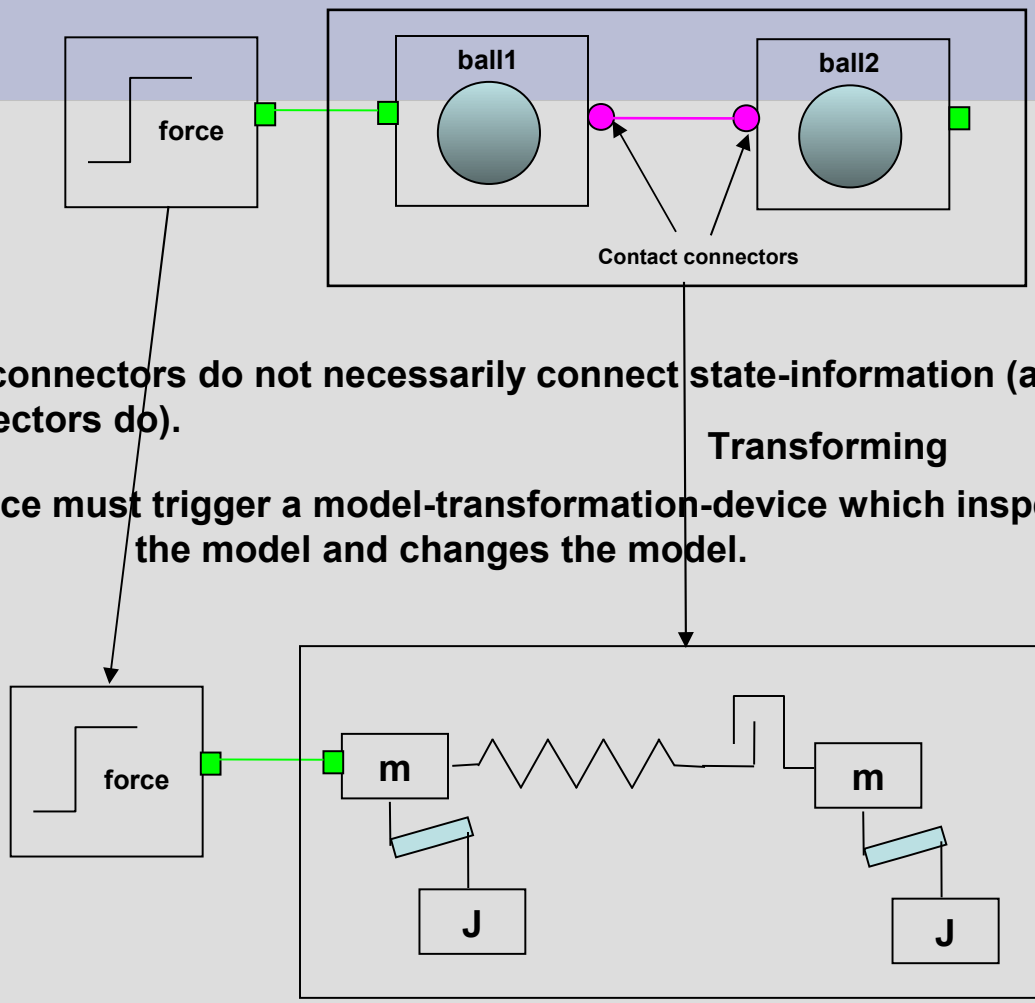
Modelica model would be:



The situation is completely determined by diameters of the balls, and the material. So I want to model:



Model transformations (3)



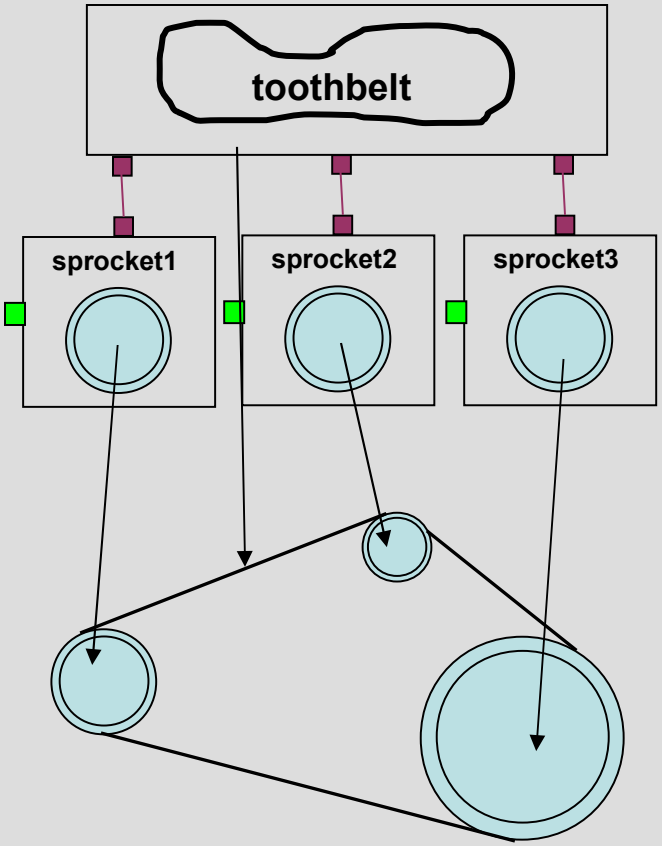
The contact connectors do not necessarily connect state-information (as normal connectors do).

Transforming

Their presence must trigger a model-transformation-device which inspects the model and changes the model.

Model transformations (4)

Where is this usefull (example engineering):



Material or type known

Position (x,y) and size and material known

Determine from this:

- **Free length belt between sprockets**
- **Stiffness and mass of belt**
- **Inertia sprockets**
- **Stiffness meshing teeth**

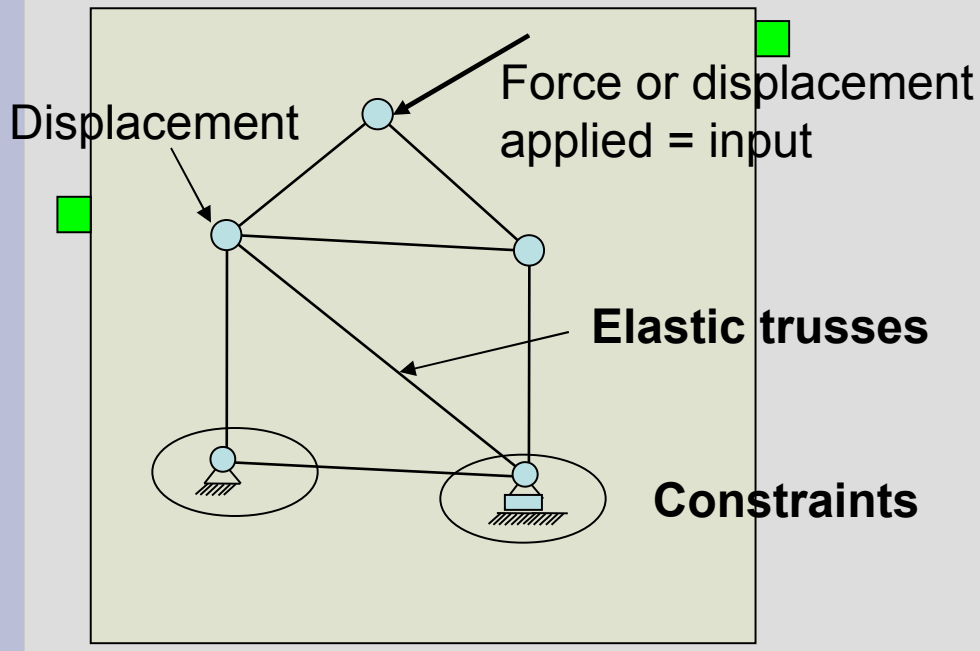
= Construct the model from this

New user interfaces

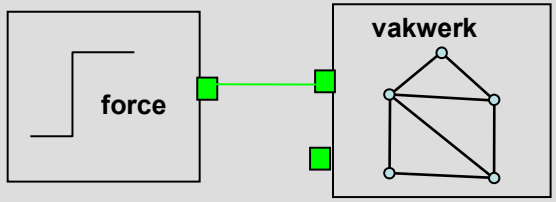
Not only from Modelica-model to Modelica-model.

The user interface of Modelica has limitations, so add our own domain specific user–interface and consider meta-model from graphs to Modelica code.

lets consider a vakwerk-construction, we want to define the trusses and connection points and that's it.



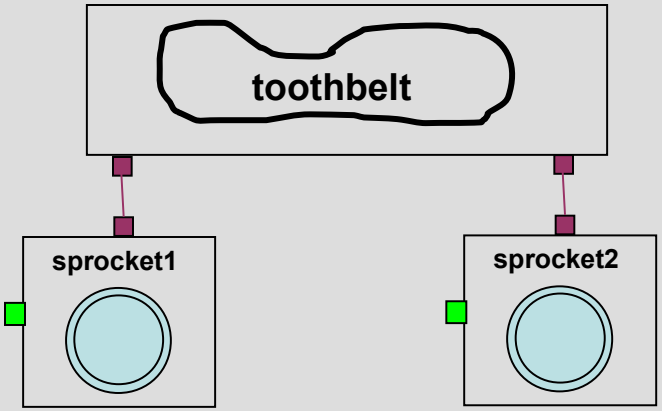
This is my model



Transformed to Modelica

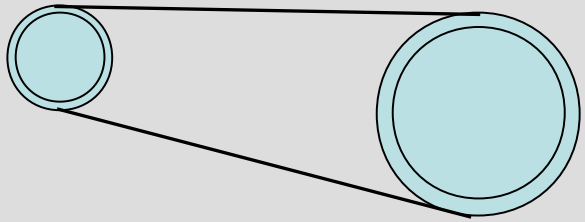
Be aware: Acausal so no inputs/outputs, This is the strength of Modelica.

Synthesis



Material or type not known, just that we use a toothbelt

Position (x,y) and ratio diameters known



Determine from this:

- Which toothbelt to use (width, stiffness)
- What material and width sprockets

Criteria could be:

- Forces known (must not break) + expert opinion safety factor or “best practices”

What I hope to achieve from this workshop

Goals:

- Get an understanding how the graph-approach can help me reach my goals (domain-specific GUI's, Modelica→Modelica-transformations, synthesis drive-components).
- How does the graph-approach compare to functional programming (incl. stylesheets) and semantic database (Simantics).
- Get an understanding of how graphs are currently used in domain of mechatronics
- Get a working GUI + model-generator of a truss-construction
- Get a working model-transformation on contact (2 balls!) via different paradigma's. Determine which are practical