Application Note: Equivalent Mechanism Inertia

Introduction
In many cases it is desirable to calculate the inertia that the motor "feels" as function of the motor angle (= inertia of the motor + equivalent inertia of the rest of the mechanism). This application note describes a way to achieve this result using the mechanism design software SAM.

Basics

The basic idea is to use a very special input motion file to drive the crank axis of the. The input motion file, which defines a physically non-feasible motion profile, has the following characteristics :

```
0     0    0    1
t1    x1   0    1
t2    x2   0    1
:     :    :    :
:     :    :    :
tn    xn   0    1
```

With this motion profile the mechanism moves to each angle x1, x2, ...xn and at this angle a force analysis is carried out based on zero-velocity and an acceleration equal to "1". As a result of this the calculated motor torque T [Nm] equals the equavalent inertia [kgm^2] multiplied by 1 [rad/(s^2)].

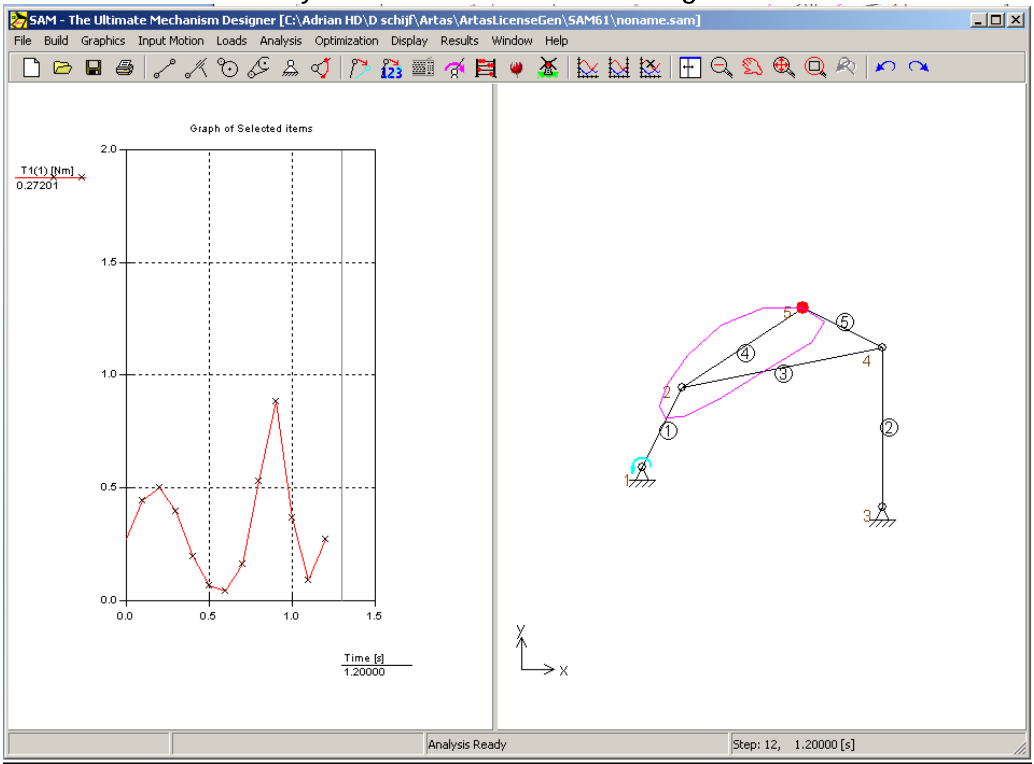
Note: Please select the SI[rad] system of engineering units (if the latter is not the case, please take care to properly interpret the results). Also it is essential to disable any gravitational effects.

Example 1
As an example the equivalent mechanism inertia of a 4-bar mechanism with a mass at the coupler point is demonstrated. The mechanism is driven by a motion file which devides a complete revolution of the crank into 12 steps.

The example is based on the default 4-bar mechanism that is generated by the command sequence FILE / WIZARD / 4 BAR MECHANISM and by accepting the default values. In addition to that a mass of 10 kg is added to point 5 of the mechanism. Instead of the default input motion, which is deleted, the following input motion file is selected:

```
0.0 0.0    0.0 1.0
0.1 0.5236 0.0 1.0
0.2 1.0472 0.0 1.0
0.3 1.5708 0.0 1.0
0.4 2.0944 0.0 1.0
0.5 2.6180 0.0 1.0
0.6 3.1416 0.0 1.0
0.7 3.6652 0.0 1.0
0.8 4.1888 0.0 1.0
0.9 4.7124 0.0 1.0
1.0 5.2360 0.0 1.0
1.1 5.7596 0.0 1.0
1.2 6.2832 0.0 1.0
```

The results of this analysis are shown in the following screenshot..



Example 2

Example 2 is very similar to example 1, only now an extra motor inertia of 1 kgm^2 is added to the crank.