

A braking system for a train

Your neck-tie-wearing boss has for some reason decided to buy an Italian made train. As it turns out the trains braking system does not work. Your assignment is to design a new braking software system for the train.

On the train each wheel is attached to an electric motor, which works both as an engine and a brake. The motor is controlled by a simple computer controls. That computer can control and monitor the rotation speed of the wheel. The setup is shown in fig 1.

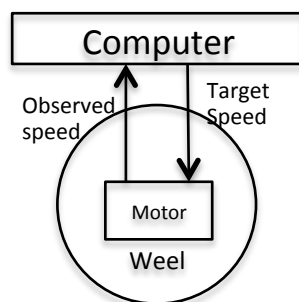


Figure 1. A train wheel, motor and control computer

The computer receives an absolute target speed in the interval $[0:100]$ from a central control unit. When the computer sets a new speed at the motor it should monitor the observed speed of the wheel, if the observed change is larger than 1 between two observations the wheel is malfunctioning, i.e. it may be blocking during a braking operation or spinning during an acceleration. In this case the computer should split the acceleration in two steps to help avoid the problem. Note that this solution may be applied repeatedly so that a large acceleration, positive or negative, may be split into many smaller accelerations to avoid blocking or spinning the wheels. A wheel is part of a wheel-set, one on each side of the train, and in addition to controlling the correctness of its own wheel a computer is also responsible for coordinating with the other wheel in the same set to guarantee that both wheels are running at the same speed which is necessary on rails. To ensure this the computers opposite each other exchange observed speeds as they arrive. The setup is shown in fig 2.

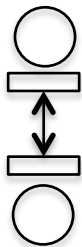


Figure 2. A pair of train wheels that should be synchronized

Your software, based on a CSP library of your own choice, should implement a train with 10 sets of wheels, i.e. 20 wheels, that may receive a target speed and

then reach that speed while compensating for blocking and spinning and ensuring that both wheels are synchronized.

Your software should work as a simulation of the train set. You are responsible for setting up a simple test scenario yourself, make sure that you test both positive and negative acceleration as well as wheel blockage, spin and uneven speeds in a set. In your report you must provide CSP diagram that shows the final simulation setup, explains how you avoid deadlocks, live-locks and how the overall simulation is shut terminated.

In all the report on this portion may not exceed two pages, excluding source-code but including a graphical representation of your network.

If you find that there are any ambiguities or missing information in the description of the assignment you have two options: either ask on the Absalon forum or make your own assumptions, which you then specify in the report. If you make your own assumptions you should not make any such assumptions that will make the assignment trivial or in any way hinder the primary objective of this assignment, which is to test your ability in concurrency design and implementations.