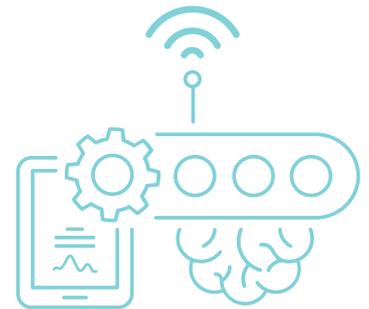


DECISION & CONTROL

DESIGN AND IMPLEMENTATION OF VIRTUAL FORCE AND TORQUE SENSORS

In the development phase of new machines and vehicles, the drivetrain is often a key subsystem. In order to gain maximum insight in the behaviour of these drivetrains, force and torque measurements are highly valuable. However, direct measuring of force and torque values in modern machines and vehicles is often not possible due to the costs, complexity and intrusiveness of the required sensors. Flanders Make offers a solution involving virtual sensing of force and torque, where cheap and low-intrusive sensors are combined with a model-based approach to indirectly, yet accurately measure these key parameters.

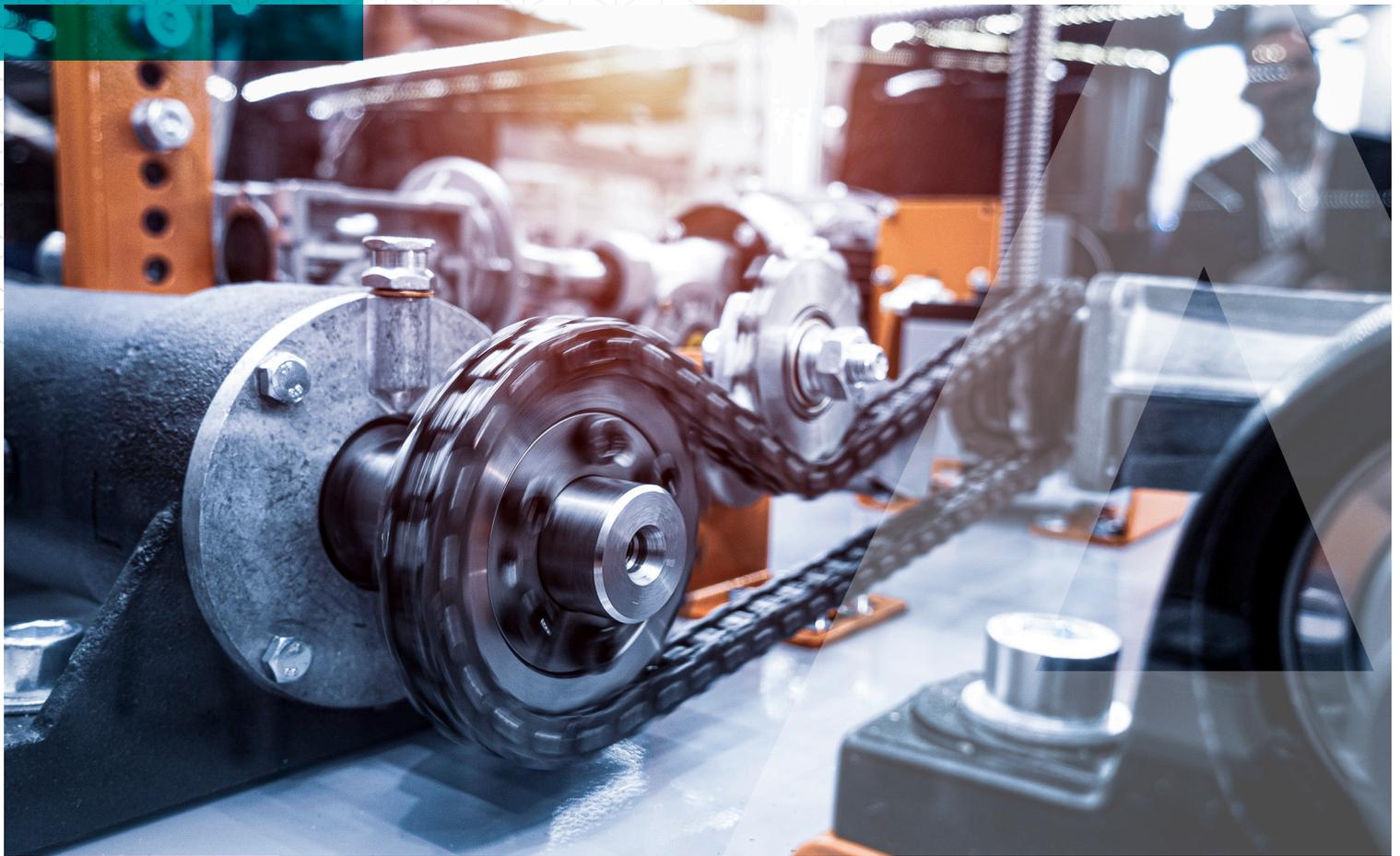


This unique approach leverages the power of our drivetrain knowledge and physical modelling. We offer:

- affordable solutions for non-intrusive torque measurements in drivetrains;
- methodologies and tools to generically design, calibrate and validate model-based virtual force and torque sensors;
- sensor selection and placement;
- physical modelling of sensed component or system;
- support for online deployment of virtual force and torque sensors in real-time systems;
- design and validation tools for online, real-time virtual force and torque sensors.

We use various unique software and hardware tools in this process:

- We use toolboxes for:
 - model-based force and torque estimation;
 - vehicle dynamics estimation;
 - multi-sensor multifunctional topology optimisation.



SUCCESS STORY

Torque estimation improvement through periodicity exploitation

PROBLEM

Companies need to know the operational loads (torques) of the drivetrains in machines. However, measuring torques is expensive and intrusive, and often not possible due to geometrical, durability and/or safety constraints.

SOLUTION

Virtual sensing allows to estimate torques using cost-effective sensors, such as encoders, without the need to install torque sensors. Approaches to account for the operating conditions, such as periodicity exploitation, can further improve estimation accuracy up to a factor two.

CUSTOMER VALUE

Accurate torque estimation using low-intrusive, cost-effective sensors