VORTECH

Data assimilation

Observations and computer models are both valuable sources of information for monitoring and control. Data-assimilation is the method to make models consistent with observations. This allows better predictions and more complete information coverage.

Make the most of your computer models and measurements

scientific software engineers

Nowadays, computer models are used extensively to study and monitor systems in the world around us. They can be applied in various fields, be it weather forecasts, water management, industry or ecomonics. Computermodels enable us to study a system in detail and predict future states. Models do, however, tend to simplify reality.

Measurements on the other hand are an important source of information. They give us a handle on the aformentioned systems. Measurements will inform us on the actual state that the system is in, but they only give us information about a limited number of the system's properties or locations. Moreover, measurements as such have no predictive value.

The predictive qualities and resolution of computer models can be combined with information about the actual state of the system as derived from observations and measurements by means of data assimilation and model calibration techniques.

Applications

There are many situations in which models and measurements can be combined. Here are some examples:

Automatic calibration of models; extraction of drinking water

To extract drinking water, water is pumped out of a vertical well. In due time, fine particles can gather around the well, blocking the flow. This can cause dry pumping of the well, with dire consequences. For that reason, pressure sensors have been placed in the well, so that the pumps can be switched off before damage has occurred. The measurements taken from these sensors can also be used to design and calibrate a model of the groundwater in the area. This model is much more effective in determining the scale of the blockage and at what time the wells can be most effectively regenerated.

Data assimilation will give you more accurate predictions; pollution of sewage systems

Sewage systems need to be monitored, repaired and

cleaned regularly. They can be inspected by means of fixed cameras and robots. These forms of inspection render only a small amount of information and are very costly. By combining the observations with a computer model, the state of the system can be determined much more precisely. This makes for more specific inspection, thus saving time and money.

Complementing measurement sequences; air flow in the vincinity of rotor blades

Inside a wind tunnel, the air flow around rotor blades can be measured accurately. Unfortunately, there are some very interesting locations which cannot be observed. By combining a computer model with the measurements that can be obtained, we can create a physically reliable overall picture of the air flow around the rotor blades, whereby the model fills in the blanks.

Optimal placement of sensors

Sensors are often placed with a certain goal in mind. However, often at the time of placing the sensors, not all the necessary specifications or best locations have been defined. The same mathematical methodology that is used to combine measurements and models, can be used to solve this issue. We determine the locations in the system that will have a maximum effect for calibration and data assimilation.

What can VORtech do for you?

VORtech specialises in services in the field of computer modeling. We have 20 years of experience in combining measurements and models both within large operational systems and applications on a smaller scale. VORtech is one of the main developers of OpenDA, a free, open source platform for data assimilation. The main goal of OpenDA is

to bring universal access to data assimilation and model calibration techniques in an open source framework.

VORtech's consultants can help you combine powerful computer models with realistic measurements of the system. We offer advice, (partial) implementation or full turnkey solutions. Among others, our services are

- Advice on how data assimilation techniques can be used in your application area;
- Advice on which data assimilation algorithms are most suited for your situation. We can also custom design an algorith for you;
- Developing computer models to supplement your measurements;
- Advice on how to set up a sensor network for a new system. This will help you to define the optimal placement of sensors and make decisions on what to measure;
- Implementation of data assimilation or calibration systems. We can either use OpenDA or tailor made software;
- Management and maintenance of your data assimilation or calibration software.

Interested?

For further information on the possibilities of data assimilation and automatic calibration of your software, please contact Nils van Velzen.

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