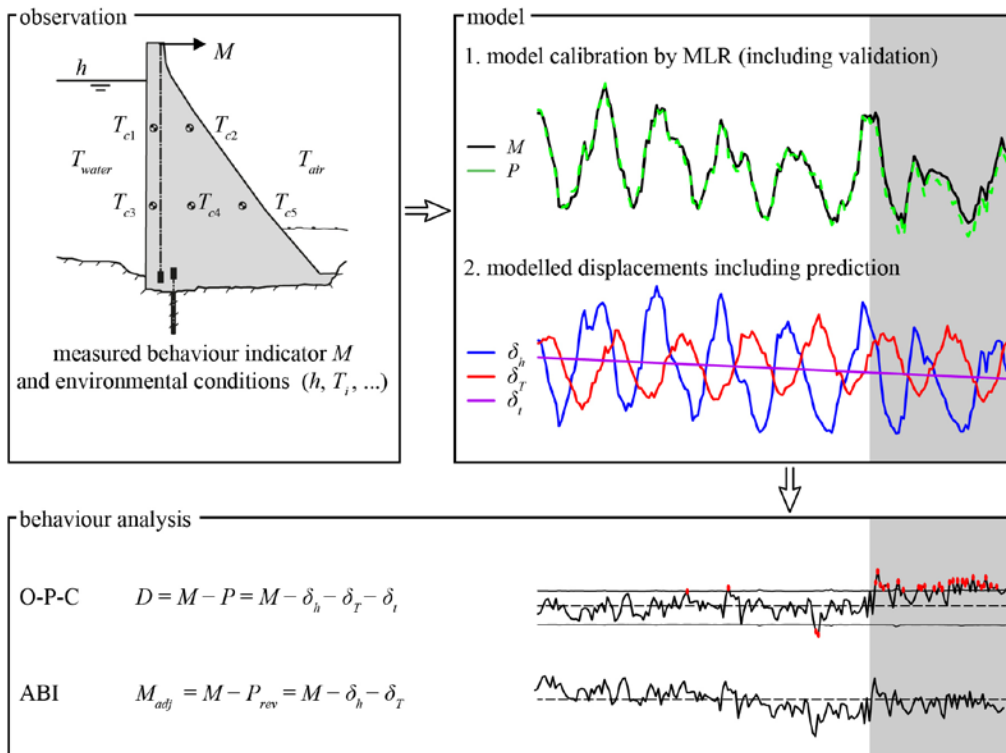


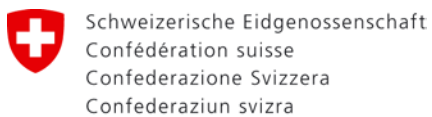
TRAINING COURSE

Dam behaviour Analysis with DamBASE software

16th of January 2019
ETH Zentrum, Zürich



Organized by:



Federal Department of the Environment, Transport,
Energy and Communications DETEC
Swiss Federal Office of Energy SFOE
Section Supervision of Dams



Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich



Laboratory of Hydraulics,
Hydrology and Glaciology

GOALS

Concrete dam related long-term processes, such as valley deformation, concrete ageing, alkali aggregate reaction and changes in seepage flow can lead to damage or even failure of the structure. Dam monitoring is essential to recognize abnormal behaviour at early stage. Basically, there are two modelling approaches for dam monitoring; the deterministic method links input variables and the behaviour of the structure on the basis of physical laws, and the statistical method links them by regression analysis. The latter will be introduced in this training course. The main topics of the course are described below.

Fundamentals of statistical models

The application of common statistical modelling approaches for behaviour analysis may not be straightforward. First of all, a regressor model equation that approximatively describes the relationship between the environmental conditions and the behaviour of the structure has to be defined. Fundamentals relevant for setting up a statistical model will be introduced. Furthermore, statistical tests to check the model adequacy and approaches for model validation and comparison are shown.

Heat transfer analysis

The displacement caused by temperature effects inside the concrete body is one of the main contributions to total displacement. In dam behaviour analysis, the information of thermometer readings, embedded in the dam at different positions, shall be linked to the measured displacement to estimate the thermal effects. There are statistical approaches that use the mean temperature T_m and the temperature difference between the upstream and downstream dam faces T_d as a basis for the regression model. These quantities physically cause the displacement of the structure. The theory of heat conduction will be shortly introduced; then practical application examples of 1D heat conduction analysis of concrete dams are shown.

Behaviour analysis

There are different ways to carry out a behaviour analysis. Commonly, the observation-prediction comparison (OPC) is performed. Alternatively, the approach of adjusted behaviour indicators (ABI) can be used. The difference of these two procedures will be explained and both approaches will be learned by application of the DamBASE software.

Hybrid models

In dam behaviour analysis, hybrid models are statistically optimised deterministic models. Thus, the hybrid model can be seen as a deterministic model with adjustment of the global stiffness and the thermal expansion coefficient. It will be shown how results from deterministic models can be imported and how hybrid models can be created within DamBASE.

TARGET AUDIENCE

This training course is addressed to interested Swiss dam experts, especially to experienced professionals of level 2 and experts of level 3.

CONCEPT / LANGUAGE

During the course, each topic will be introduced by a brief overview of the state-of-the-art and a summary of fundamentals. Demonstrations of practical application examples using the DamBASE software should improve the understanding and support the knowledge transfer from theory to practice. The participants are invited to make their own experience and learn the software in more detail by hands-on sessions guided by the speakers.

This training course will be held in **English** corresponding to the software and the manual.

FURTHER INFORMATION AND REGISTRATION

To follow the hands-on sessions, the participant has to bring his own laptop with the current version of DamBASE installed (see www.dambase.ethz.ch).

Please contact us, if you have any questions:

Petra Bratfisch
ETH Zurich
Laboratory of Hydraulics, Hydrology and Glaciology (VAW)
Hönggerberggring 26
8093 Zürich

info@vaw.baug.ethz.ch
+41 44 632 40 91

Please send in the enclosed form for registration.

REGISTRATION FEES

Total costs per person: CHF 150.-

Fees include: guided hands-on sessions, course notes (slides), food and beverages during coffee breaks, lunch time and apéro.

CERTIFICATE

A certificate of attendance will be issued to the participants.

ORGANISATION

Laboratory of Hydraulics, Hydrology and Glaciology (VAW) of ETH Zurich, www.vaw.ethz.ch
in collaboration with
Swiss Federal Office of Energy (SFOE), Supervision of Dams, CH-3003 Bern, www.bfe.admin.ch

LOCATION

ETH Zentrum, Zürich. Building and room to be defined.

SPEAKERS

Georges DARBRE

Commissioner for Dam Safety, Swiss Federal Office of Energy SFOE, Ittigen

Robert BOES

Professor of hydraulic structures and Director of the Laboratory of Hydraulics, Hydrology and Glaciology (VAW), ETH Zurich

Marius BÜHLMANN

Project Manager HOLINGER AG, Olten (formerly VAW, ETH Zurich)

David VETSCH

Head of numerical modelling division at VAW, ETH Zurich

PROGRAM

	<i>Topic</i>	<i>Speaker</i>
09:00 - 09:15	Registration	
Opening		
09:15 - 09:25	Course opening	Robert Boes
09:25 - 09:45	Predictive behaviour models in dam safety	George Darbre
09:45 - 10:10	Introduction	Marius Bühlmann
Fundamentals of statistical models		
10:10 - 10:40	Multiple-Linear-Regression (MLR)	Marius Bühlmann
10:40 - 11:00	Coffee break / computer setup	
11:00 - 11:10	Alternative approaches	Marius Bühlmann
11:10 - 11:40	Introduction to DamBASE and demo	David Vetsch
11:40 - 12:15	Hands-on: case study	Marius Bühlmann
12:15 - 13:30	Lunch	
Heat transfer analysis		
13:30 - 14:00	Fundamentals	Marius Bühlmann
14:00 - 14:10	Demo: case study	David Vetsch
14:10 - 14:30	Hands-on: case study	Marius Bühlmann
14:30 - 15:00	Coffee break	
Behaviour analysis		
15:00 - 15:30	Fundamentals	Marius Bühlmann
15:30 - 16:05	Hands-on: case study	David Vetsch
16:05 - 16:15	Prediction vs. Inference	Marius Bühlmann
Hybrid models		
16:15 - 16:30	Fundamentals	Robert Boes
16:30 - 16:40	Hybrid models in DamBASE	David Vetsch
16:40 - 17:00	Hands-on: case study	Marius Bühlmann
17:00 - 17:15	Summary	Robert Boes
17:15 - 18:00	Apéro	

DamBASE SOFTWARE

In 2004, the Swiss Federal Office of Energy (SFOE) launched the Software DamReg in which MLR models can be set up and evaluated. DamReg has been re-engineered at the Laboratory of Hydraulics, Hydrology and Glaciology VAW of ETH Zurich and is now called DamBASE. In doing so, the R environment has been integrated in the software to facilitate the application and testing of various procedures for statistical analysis. The current version 1.0 was released in May 2015.

The software is split up into parts related to data and regression analysis. Since setting up a regression model can be quite complex, the user interface (Figure 1) supports a basic and a scientific user mode allowing a user to do the analysis not only on statistical tests but also on physical analysis. To further support simplicity, the software allows setting up a model out of a list of predefined templates. The final analysis for both data and regression is supported by a set of analysis tools not only related to the current operation mode, but also to the user's knowledge and preferences. Furthermore, the software provides an overview of all related analyses, allowing for stepwise comparison and optimization of the created models.

Besides the option to set up common statistical models (HST and HTT), there is a simple method to consider heat conduction and an option to define hybrid models by combining splines and results from FE-models. In addition to standard regression procedures, the software provides special case treatment such as dealing with autocorrelation with extended concepts like ridge and principal component regression to handle multicollinearity.

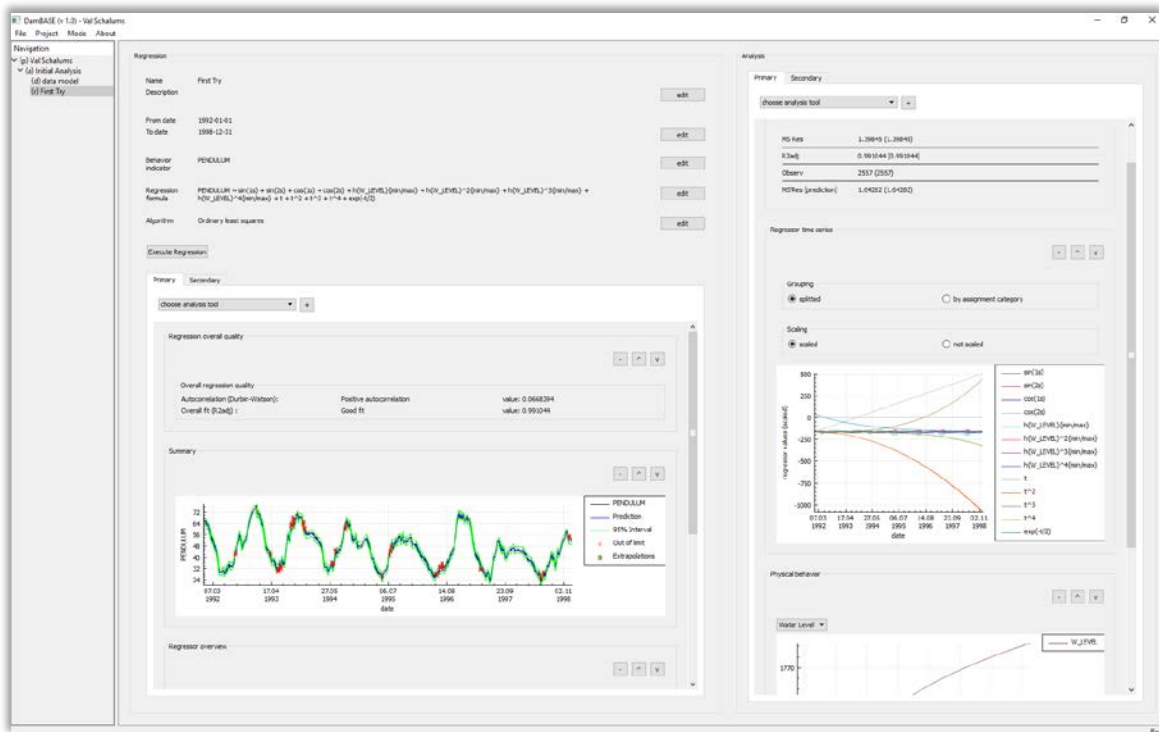


Figure 1: Graphical user interface (GUI) of software DamBASE

REGISTRATION FORM

Training course “Dam Behaviour Analysis with DamBASE software”

Date 16.01.2019
Duration 9:00 - 18:00
Location ETH Zentrum (building and room tbd)
Zürich

Surname

First name

Company

Address

E-mail address

Phone

The registration form can be handed in until 6th of January 2019 to

Petra Bratfisch
ETH Zurich
Laboratory of Hydraulics, Hydrology and Glaciology (VAW)
Hönggerberggring 26
8093 Zürich

or by email to

info@vaw.baug.ethz.ch

After receiving your registration request, we will send you the bill for the registration fee. After receiving the payment, your registration will be completed. The course is limited to 20 participants.