Technische Hochschule Ingolstadt

Electrical Engineering

TRANSIENT THERMAL SIMULATION OF HIGH POWER LED AND ITS CHALLENGES

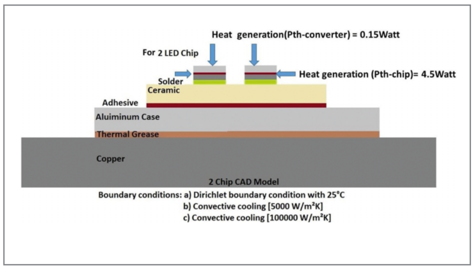

Fig. 1: 2-chip LED Model

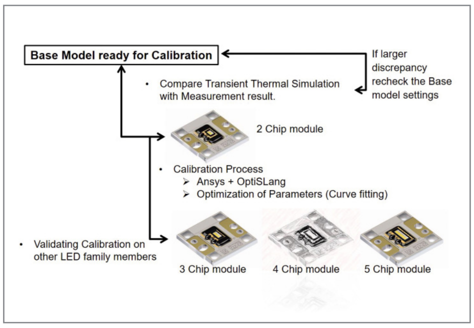

Fig. 2: Schematic Diagram of factors influencing transient thermal simulation

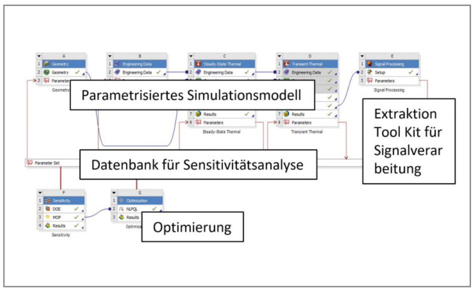

Fig. 3: Schematic explanation of Calibration process

Target, Benefit and Application

The goal of the project is to create and optimize an FE model for a family of high power LED.

Signal Processing

The time-dependent temperature data are read by Extraction Tool Kit. The measured Zth(t) is also imported as a reference input.

Sensitivity analysis and optimization

Based on DoE the design points are generated and the parameters are optimized for one LED module of the family (see Fig. 3).

Results and conclusion

- The calibrated parameters are used to simulate the other LED modules of the LED family.
- The simulation results fit well to the measured Zth curve.
- The validation range of the optimized parameters is therefore confirmed for the whole LED module family.

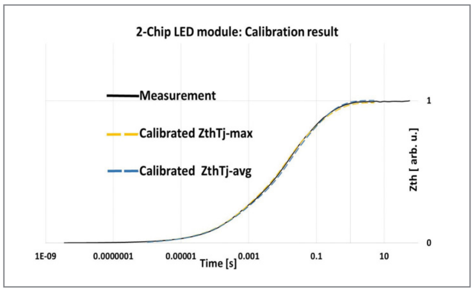

Fig. 4: Calibrated results for 2-chip LED module

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OSRAM Opto Semiconductors
In cooperation with OSRAM Opto Semiconductors

TECHNISCHE UNIVERSITÄT WIEN

Civil Engineering

ENGINEERING FRAMEWORK FOR OPTIMIZING GLUED LAMINATED TIMBER

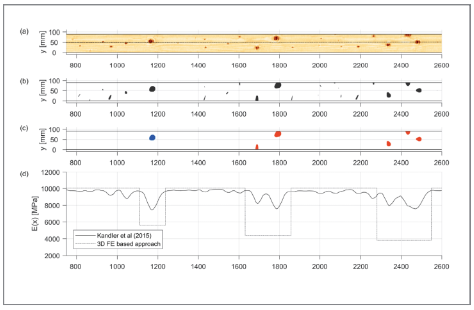

Fig. 1: (a) For a regular board, (b) a knot fitting algorithm automatically reconstructs the 3D knot geometry. (c) After grouping, only the most important knot groups are retained in the model. In (d), stiffness profile results computed by two distinct approaches are displayed.

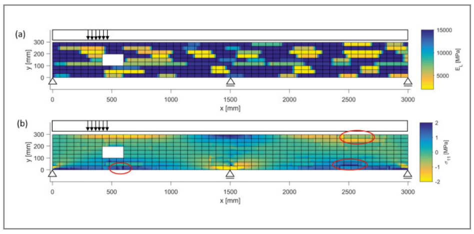

Fig. 2: (a) Random spatial distribution of stiffness values generated from random process model and (b) resulting stress distribution. Regions with abnormal stress peaks due to the heterogeneous material model are marked in red.

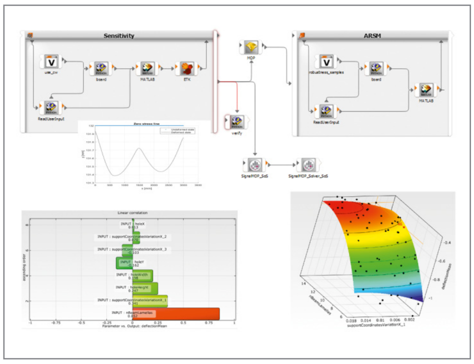

Fig. 3: Results of sensitivity analysis and MOP can be assessed, since the tool is tightly implemented into the optiSLang and SoS workflow.

Motivation

Due to the natural growth process of trees, wooden boards, typically used for structural load bearing elements, show a high amount of random fluctuation in their mechanical properties. To improve the competitiveness of wooden structural elements against other building materials, a numerical tool, able to consider the impact of random stiffness fluctuations of wooden boards on the performance of glued laminated timber (GLT), is developed.

Methodology

The mechanical properties of each board are obtained on basis of measurements collected during the grading process and are condensed into so-called stiffness profiles (cf. Fig. 1). Based thereon, a probabilistic material model is developed for the random generation of an arbitrary number of stiffness profiles.

Then, on basis of the probabilistic material model and a 2D finite element analysis (see Fig. 2), the displacement field and stresses can be computed. This procedure is tightly integrated into the optiSLang workflow to determine the relevant parameters (Fig. 3). For this, the governing random displacement field is identified by employing the SoS library. Subsequently, application of ARSM leads to the optimal design parameters of the user-defined structure.

Conclusion

Through the knot morphology, mechanical models for wood on the microscale are linked to the mechanical behaviour of wooden boards at the macroscale. By incorporating these results into the design workflow, a fully probabilistic assessment of glued laminated timber beam systems and their sensitivity to material variability is possible.

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Medical Science

PATIENT SPECIFIC 3D MODELS FOR VIRTUAL OPERATION PLANNING IN PLASTIC SURGERY

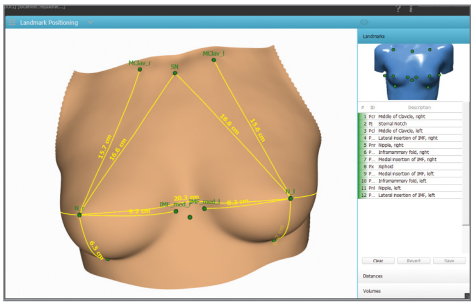

Fig. 1: Anatomical measurements on template model

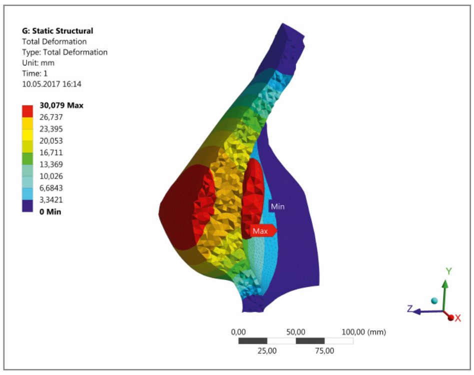

Fig. 2: Results of simulation

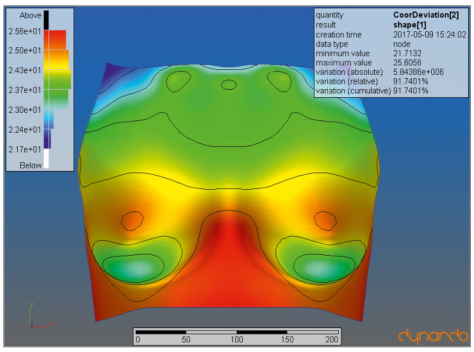

Fig. 3: A shape function in Statistics on Structures (SoS)

Objective, benefit and practical use

The objective is to develop a workflow which generates parameterized patient specific 3D body surface models of different anatomical regions using the example of the female breast. In plastic surgery, the evaluation of changes of the body surface is based mostly on simple 2D images. Thus, it is difficult for surgeons to gain any objective evaluations of the changes after a surgery. However, an objective and quantifiable evaluation is necessary for individual surgery planning. For the evaluation, it is also important to conduct a long time investigation of the healing process after a surgery. By using parameterized 3D surface models, it is possible to make quantitative predictions of these changes.

Surface fitting and template models

Nowadays, the 3D surface scans often show holes and other artefacts. To improve the quality, a standard template model was developed which can be fitted to the scan. Thus, patient specific and artefact free parameterizable surface models can be generated. On the fitted models, one can measure anatomical parameters like special distances and the volume of the breast (Fig. 1). This allows a quantitative evaluation of the surface scan. An enhancement is the fitting of a volumetric model to a surface. Such a model can be used for patient specific simulation and the selection of different implant layouts in ANSYS Workbench (Fig. 2).

Parametrization

The standardized structure of the fitted patient specific template models enables the development of a parameterized model using medical and anatomical parameters. Here, the software "Statistics on Structure" identifies characteristic parameters and generates field meta models (Fig. 3). Through variation of the parameters, the changes of the body surface can be predicted.

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ZIM Zentrales Innovationsprogramm Mittelstand

Geomethermie

STUDIE ÜBER DIE EINBINDUNG EINER HYDROTHERMALEN WÄRMEQUELLE

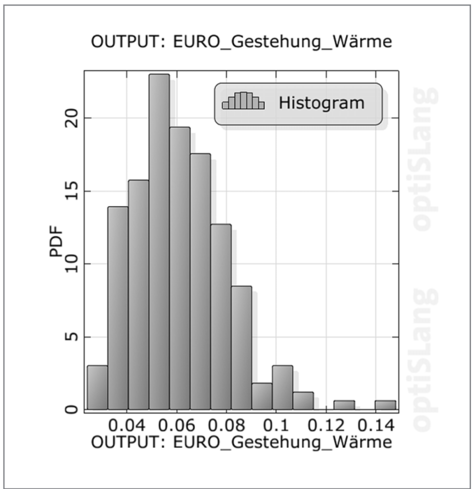

Abb. 1: Verteilung der Gestehungskosten Wärme [€/kWh] in einem Histogramm. Der Mittelwert aller 200 Berechnungen der Monte-Carlo-Simulation beträgt 0,061 ± 0,019 €/kWh.

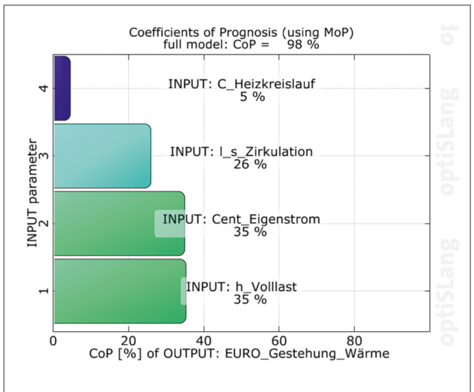

Abb. 2: Abhängigkeit der Zielgröße Gestehungskosten Wärme [€/kWh] (EURO_Gestehung_Wärme) von den untersuchten Variablen auf Grundlage eines n-dimensionalen Zusammenhangmodells (optiSLang v4)

Motivation

Die Stadtwerke Energie Jena-Pößneck GmbH plant, den Anteil erneuerbarer Energien an der Fernwärmeerzeugung weiter zu erhöhen und prüft dafür die Integration von Geothermie ins Jenaer Fernwärmenetz. Im Rahmen des GREEN-Invest Förderprogramms der Thüringer Aufbaubank erfolgt eine Untersuchung zur technischen und wirtschaftlichen Machbarkeit im Stadtgebiet von Jena.

Parameterstudie

In einem ersten Schritt erfolgte eine Parameterstudie zu den Wärmegestehungskosten. In deren Ergebnis zeigen die Wärmegestehungskosten aus mitteltiefen geothermischen Reservoiren weite Spannbreite in Abhängigkeit der Anlagenskalierung, Betriebsszenarien und Eigenstromkosten. Nicht alle Szenarien führen zu ökonomisch sinnvollen Lösungen, es können aber bereits schon mit mittleren Annahmen wirtschaftlich sinnvolle Kombinationen abgeleitet werden (Abb. 1).

Die Gestehungskosten Wärme unterliegen in Abhängigkeit der folgenden untersuchten Variablen sehr großen Schwankungen:

- Zirkulationsrate des untertägigen Anlagenteils: 10 – 50 l/s
- Produktivität Aquifer: 0,75 – 3 l/s*bar
- Jahresvolllaststunden: 2.400 – 8.000 h
- Temperaturniveau Heizkreislauf: 30 – 80 °C
- Eigenstrompreis: 0,04 – 0,18 €/kWh

Ein wesentlich besserer Zusammenhang zwischen den Variablen und der Zielgröße wird mit einem Zusammenhangmodell (MOP – Metamodel of Optimal Prognosis) auf Grundlage nichtlinear mathematischer Funktionen abgebildet. Abb.2 zeigt die Abhängigkeit der Zielgröße Gestehungskosten von den untersuchten Variablen auf Grundlage nichtlinearer Abhängigkeiten. Hiermit kann das Verhalten der Zielgröße zu 98 % erklärt werden.

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