ingenhoven

main station stuttgart • construction

The overall concept is an optimized load-bearing structure, using as few elements with as many functions as possible. Physical and digital models were developed during a complex process of form finding.

The target is to synchronize the results of studying the structural characteristics and reactions of forms and their functional requirements.

Soap Bubble Test

A local force can be applied to the membrane without tensile stresses even possible in combination with a hole - “the eye“. Based on this ideal form the structure was continuously developed and adapted to the base conditions.

Model Studies 1 - 4

The complex shape of the shell structure was developed in close consultation with Frei Otto and tested and confirmed on more than 40 working models.

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Team meeting with Frei Otto

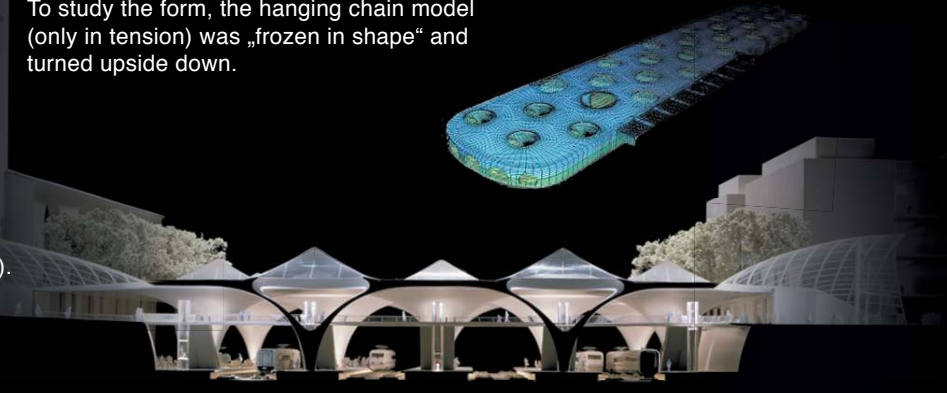
Starting from a hanging chain model (cable net structure), the structural analysis lead to the decision to invert the model. This created an arched shell in compression.

In that case the optimum form is achieved when all permanent loads are transferred to compressive forces in most cross sections. To study the form, the hanging chain model (only in tension) was „frozen in shape“ and turned upside down.

The result reflected the original vision for the new station concourse, based on the use of optimal natural forms.

optimized construction

The three-dimensional shell, which is mainly subject to compression, makes it possible to achieve maximum ceiling height with a minimal structural thickness of 1/100th of the span (minimisation of material). Completing the modeling on the computer allowed for mathematical verification.



Light Eyes

The glass steel façade for the light eyes is an optimized double curved structure of triangular profiles which allows for minimum profile size and maximum natural daylight in the entire hall.