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Advances in Simulation of Technical Meshes

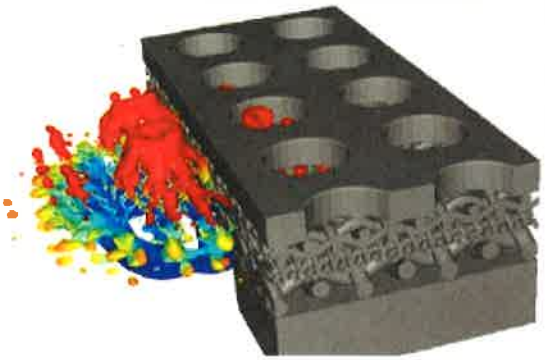
Computer simulation of technical meshes for the optimization and design of application-specific mesh types has been an ongoing research subject. About a year ago, the German firm GKD – Gebr. Kufferath AG (GKD) achieved a breakthrough, and further development of the company's simulation tool now enables construction of even multilayer mesh types.

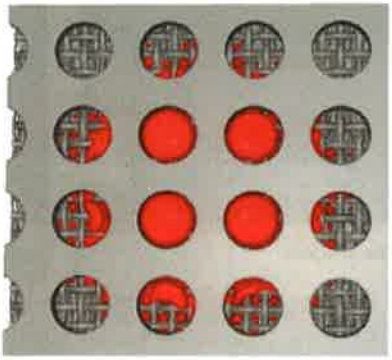
Virtual mesh is useful in highly complex mesh applications, such as for sand control screens in the offshore oil production industry.

Expanded Capabilities

The WeaveGeo simulation tool, further developed by technical weaving mill GKD and used for the virtual simulation of mesh designs, is now well established on the market. Designed for the simulation, optimization, and generation of new types of application-specific mesh, the software, with 3D visual display, offers previously unimagined potential for use in many sectors. GKD is now expanding the simulation capabilities so that with WeaveGeo and LayerGeo, GKD can now reproduce and optimize even multilayer mesh structures that are just like the real thing.

Picture 1 and 2: A 3D monochrome sectional view(1) and full view(2) of the local speeds.





Picture 3: Simulation of the multilayer design with perforated plate, square mesh, filtration mesh, second square mesh and pipe.

Picture 4: Monochrome 3D image of the local pressure differences.

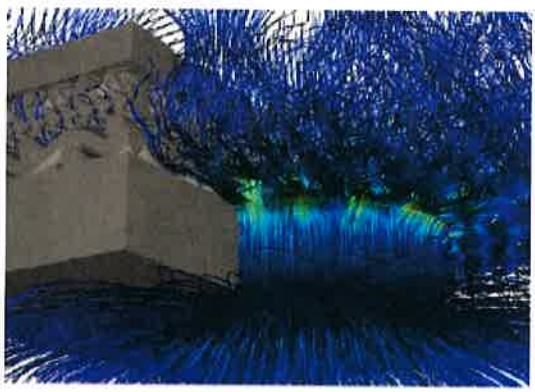
Sieving and filtration meshes perform a variety of tasks in solid/liquid filtration. GKD determines the ideal parameters for optimal mesh structures with the aid of CFD simulations, among other things. Aiding this process is the WeaveGeo software tool, which uses the GeoDict software suite for the mesh industry. GKD works in close collaboration with the customer to choose types of mesh and patterns that are suitable for the specific application, and determines their behavior under the relevant process conditions using complex mathematical algorithms.

To calculate the relevant mesh parameters, the mesh pattern, wire diameter of warp and weft, warp and weft pitch, crank factor, as well as rigidity and ovality of the wires, can all be altered virtually by means of CFD simulations. The computer simulations illustrate the mesh behavior, as well as flow and filtration properties. Parameters such as the maximum glass bead diameter, filtration efficiency, pressure drop at a specified media flow including filter cake, flow rate at a specified differential pressure, as well as the bubble point, can be visualized and previously hidden processes clearly followed as a result. On this basis a mesh or mesh package with optimum filtration properties can be defined in no time at all. If necessary, a corresponding prototype can then be produced and tested in the lab.

Simulation of Multilayer Mesh Combinations

GKD has now succeeded in transferring this process to multilayer woven filtration mesh with its WeaveGeo software tool. Multilayer meshes combine the benefits of various types of mesh in just one medium. For example, with a combination of monofilament stainless steel wires and metallic fibers, surface and depth filtration can be achieved in a single medium. Innovative mesh designs combine increased flexibility, mechanical stability, high throughput with lower differential pressure, as well as absolutely consistent pore distribution. A weave design stored in the WeaveGeo software tool depicts the direction of the warp wire. In addition to multilayer mesh, even cables -- together with the length and direction of lay as well as the strands -- can be designed and generated within a short period of time.

Picture 5: 3D visualisation of the flowlines.



Picture 6: Simulation of the multilayer mesh with a reduced number of flowlines.

With the help of 3D simulations, GKD is producing multilayer mesh in 8 different grades within the 60 to 600 µm range for a wide variety of applications, especially for the sand control business. For example, various combinations of KPZ mesh, plain Dutch weaves, twilled Dutch weaves, and square meshes are being used as sand control screens for offshore oil extraction. By filtering sand and solids, they protect the oil pipelines against damage and prevent production outages.

Depending on conditions on-site, various grades of mesh fineness are used, each of which represents the best solution in terms of the required retention rate and the pressure loss caused by the filtration. To create a virtual model of the best project-specific mesh design with regard to the sand characteristics, information on the physical properties of the solids is fed into the program and evaluated. With the expansion of the ability to generate mesh by inputting data via weave cartridges, GKD is now able to create entirely new multilayer mesh patterns and designs.

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