NEWSLETTER SOMMER 2022

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Dear Readers

Today, there is a great need to be able to measure the various biological and physical parameters involved in walking, sport and even sleeping. It should be possible to do this flexibly with inexpensive products that are easy to handle. This is to enable a comparison over time with oneself, with others or an optimisation of our own activity. We are currently developing one of these products. It is an intelligent grip for rowing sports, which, among other things, measures the hand strength of the rower and can be mounted on conventional oars.

In the context of this development the MAM was able to utilise its pet subjects of numerically controlled engineering and simulation to determine the physical variables (e.g. stresses and deformations) that occur in the oar grip. For the conceptual design of the intelligent oar grip we compared the results of the finite element (FE) simulation with the measured stresses of the strain gauges.

Fig. 1: Intelligent oar grip

Four strain gauges determine the force, although the art of this development consisted on the one hand of producing an optimal design of the grip, and on the other, on the favourable positioning of the strain gauges. When the oar grip is touched and the rower pulls with a significant force (e.g. 300N) when executing the rowing movement, this inevitably generates unwanted force components and moments. For optimal component sizing, the grip must produce a signal that is proportional to the moving force of the oar but is insensitive in its response to the unwanted interference mentioned above (crosstalk).

The CAD-designed grip was imported directly into Femap-NASTRAN, and a realistic finite element model was created from it. The SOLID element CTETRA with the parabolic function was selected for the deformation function. This enabled an ideal adjustment of the elements to the geometric contours. The grip was stressed by the rowing force far below the linear limit of the material. It is for these two reasons that the calculated stresses are practically identical to reality (see Fig. 2). There is a strong stress gradient where the strain gauges are intended to measure and the influence of the flange connection is not negligible, as shown in Fig. 2. In this setting, and taking into account the fact that a strain gauge actually measures a mean value of the stresses present along the measurement grid, it was possible, thanks to the finite elements, to precisely position the strain gauges with an accuracy of fractions of a millimetre. The subsequent measurements on the prototype (see Fig. 3) have happily confirmed our predictions calculated by simulation.

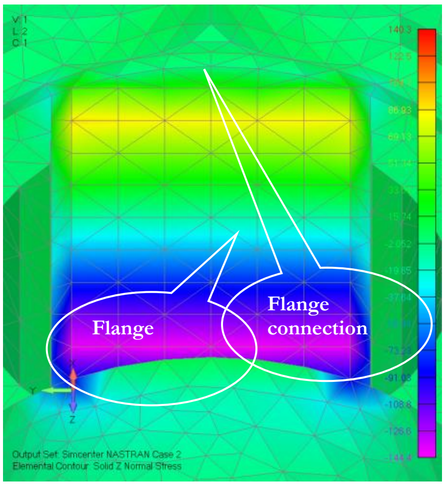

Fig. 2: Results of the FE simulation

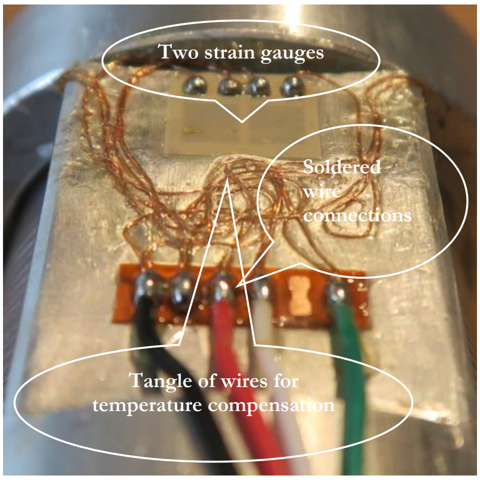

Fig. 3: Strain gauges on the prototype

This is a good example of how FE simulation can support the engineer in a straightforward way, where the mechanical part basically consists of a single element with simple boundary conditions.

MAM wishes you a lovely summer

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