DYNAMIC ISOLATION OF MACHINE FRAMES

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Initial situation

The current trends towards higher textile machine performance are based on higher processing speeds and forces resulting in increased vibration problems. Walk-in frames are often connected directly with the machines generating vibrations. Besides other parameters, vibration has considerable effects on machine safety.

A **KCL 4085 circular loom** and a **CTM 640 double carpet weaving machine** were used to demonstrate the procedure to be employed for isolating walk-in frames from the machine and for preparing the measures required to implement the solution.

The heart of the **circular loom** is the weaving unit, which consists of a heavy cast-iron housing. The unit is rigidly fastened to a sectional steel frame. Dynamic vibration generating forces are introduced directly into the machine frame causing it to vibrate. For this reason, the frame should be dimensioned so that it is able to absorb both static and dynamic loads (vibrations). The dynamic isolation of the weaving unit from the frame allows for vibrations to be eliminated.

Vibrations at the **carpet weaving machine** are mainly generated by the frame used to accommodate the jacquard machine(s). Generally, the jacquard machine is positioned above the weaving machine, on a separate and apparently stable frame. It is mechanically linked to the weaving machine via an articulated shaft and a large number of harness cords required to move the healds. The cords are transmitting tensile forces according to the filling insertion cycle. Consequently, considerable dynamic forces are applied to the frame resulting in its deflection, especially in the vertical direction, on the one hand, and vibration motions of both the jacquard machine and the frame caused by alternating forces. This project is aimed at isolating the jacquard machine from the frame.

Research target

The method used to reduce vibration was to be demonstrated. In particular, proof was to be furnished that vibration-reducing measures may allow operators to run the machine at critical speed ranges and thus increase machine performance and speed. On the circular loom, the frame was also required to be designed for improved cost-effectiveness.

Research result

The existing frame of the circular loom and a number of new frame designs were subjected to FEM analysis. Besides the visible differences in the construction of the frame, it was found that the position of the feet at the two cross-beams of the machine was of special importance in connection with the generation of vibrations in the walk-in frame. Therefore, the currently used rigid connection between the frame and the cross-beams was replaced by a fastening system provided with vibration isolators. Subsequently, the resulting effects were calculated. Among the frame designs investigated it was found that a rectangular framework system was best suited for the purpose, in both static and dynamic terms. In addition, the application of sheet bending parts reduces the cost of this version. It was not possible, however, to complete the calculation of the suggested frame because the manufacturer decided to re-arrange the machine. This had consequences for the frame height resulting in considerable effects on the static and dynamic behaviour of such frame.

Noise measurements were performed on a machine using various weaving ring diameters, warp and filling materials, and speed ranges. A noise source analysis showed that noise levels are the highest in the vicinity of the shuttle raceway and the running wheels. Noise levels were situated mainly in the 1250Hz one-third octave range.

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The filling insertion frequency of the double carpet weaving machine is continuously variable and amounts to 1-2.5Hz. However, this frequency is only one portion of the total vibration generated. There are clearly higher frequencies on account of the anharmonic time behaviour of the heald traverse. Work was performed to improve the transmission functions. Measurements required at the couplers of the jacquard machine could not be performed, because the manufacturer decided to use Stäubli jacquard machines henceforth. It was shown that the isolators provided below the jacquard machines must not be softer than those used to date. Based on FEM calculations, the following frame design improvements were suggested :

- adding diagonal rods to the bridge floor
- increasing the flexural rigidity of the bridge support by using 160x80x5mm tubular sections
- using one single section of increased stiffness in the z-direction, e.g., 400x300x16mm tubular section or larger
- moving the columns towards the inside (for improved flux of force, on account of stress at this connection, etc.)
- using hard isolators (as until now)

The measurements of the noise behaviour showed the following :

- noise depends upon speed up to 150 picks/min
- the noise portions of the weaving machine and those of the jacquard machine in total noise generation
- the immission portions of various gears and component parts
- noise abatement measures which may be taken in the short run

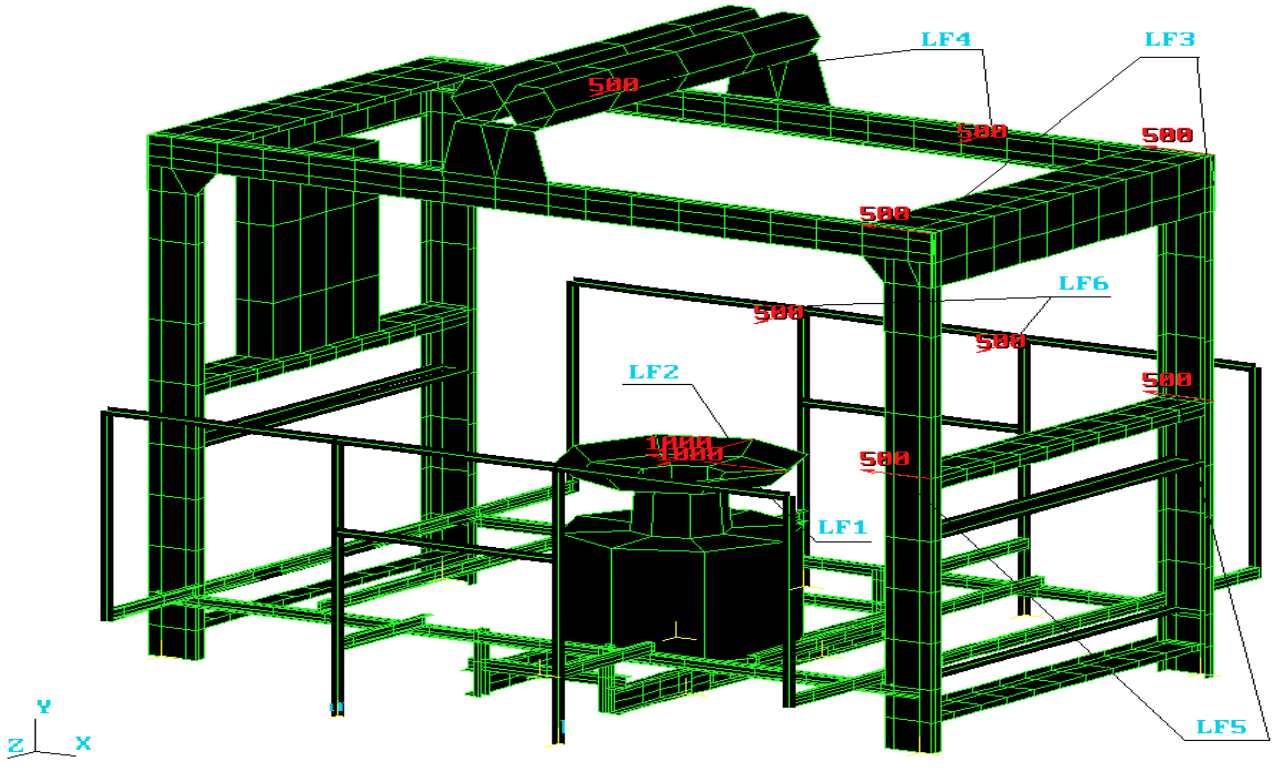

Figure: Right-angle frame for the circular loom