VIBRATION CONTROL IN INDUSTRY

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For the refurbishing of an industrial facility, several new machines will be placed on an existing concrete frame. The existing concrete frame was initially not designed for these new machines. To avoid dynamic issues such as nuisance vibrations, malfunction of the machines, damage or even failure of the production hall's structural elements, the new situation was analysed in the frequency domain with DIANA 10.2. Both the concrete frame and the machines were modelled.

Each machine has several rotating elements that can exert a dynamic load on the structure if there is a small eccentricity. In total, there are 58 rotating elements, which vibrate in a different frequency depending on the operating speed of the machine. Each dynamic load is thus unique and was analysed with a separate direct response analysis. This led to a large data set, which was combined and analysed with Python.

Results from the direct response analysis combined with eigenfrequency analysis showed that resonance occurs in the structure, resulting in vibrations that are a factor 2.5 above the specified limit of 1.12 mm/s RMS. Resonance occurs because the bandwidth of frequencies for the loading is close to the natural frequency of the structure itself. Adjustments to the concrete frame were modelled to shift the eigenfrequency outside the bandwidth of frequencies of the dynamic load.

The ability to quickly analyse many situations by using Python resulted in the conclusion that no practical adjustments to the concrete frame could shift the eigenfrequency enough to reduce the vibrations. By adding a tuned mass damper to the machine, the vibrations were eventually significantly reduced and the specified criteria were met.