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From simulation to measurement: Enhancing FE simulation for PETRA IV and EuXFEL girders

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Finite element analyses provide high-accuracy results when analysing monolithic parts like girders for accelerator components. To account for the supports and loads, simple entities such as springs and single-point masses are added to the model during design and development. However, the mechanical properties of real-world parts are often estimated, leading to deviating results, particularly on low-frequency modes, when measured in situ. To address this issue, a method is demonstrated using vibration measurements on a topology-optimised girder for the PETRA IV synchrotron radiation facility. This method allows for tuning the simulation properties accordingly. Even with simple models, an excellent correlation between measurement and simulation, spanning a wide range of modes, can be achieved. The results are then applied to different girder setups for the European XFEL to validate the approach. By comparing simulation and measurement of girders made from welded steel and ultra-high-performance concrete, the robustness of the method is discussed.

Footnotes

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