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Directional oscillations, concentrations, and compensated compactness via microlocal compactness forms

Microlocal compactness forms (MCFs) are a new tool to study oscillations and concentrations in L^p–bounded sequences of functions. Decisively, MCFs retain information about the location, value distribution, and direction of oscillations and concentrations, thus extending both the theory of (generalized) Young measures and the theory of H-measures. Since in L^p–spaces oscillations and concentrations precisely discriminate between weak and strong compactness, MCFs allow to quantify the difference between these two notions of compactness. The definition involves a Fourier variable, whereby also differential constraints on the functions in the sequence can be investigated easily. Furthermore, pointwise restrictions are reflected in the MCF as well, paving the way for applications to Tartar's framework of compensated compactness; consequently, we establish a new weak-to-strong compactness theorem in a "geometric" way. Moreover, the hierarchy of oscillations with regard to slow and fast scales can be investigated as well since this information is also is reflected in the generated MCF.