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Fourier-domain Mobility Spectrum Analysis (FMSA) for Characterizing Semiconductors with Multi-Electron/Hole Species[1] BOYA CUI, EDWARD KIELB, JIAJUN LUO, YANG TANG, MATTHEW GRAYSON, Northwestern University — Superlattices and narrow gap semiconductors often host multiple conducting species, such as electrons and holes, requiring a mobility spectral analysis (MSA) method to separate contributions to the conductivity. Here, a least-squares MSA method is introduced: the QR-algorithm Fourier-domain MSA (FMSA). Like other MSA methods, the FMSA sorts the conductivity contributions of different carrier species from magnetotransport measurements, arriving at a best fit to the experimentally measured longitudinal and Hall conductivities σ_{xx} and σ_{xy}, respectively. This method distinguishes itself from other methods by using the so-called QR-algorithm of linear algebra to achieve rapid convergence of the mobility spectrum as the solution to an eigenvalue problem, and by alternately solving this problem in both the mobility domain and its Fourier reciprocal-space. The result accurately fits a mobility range spanning nearly four orders of magnitude ($\mu = 300$ to 1,000,000 cm^2/V·s). This method resolves the mobility spectra as well as, or better than, competing MSA methods while also achieving high computational efficiency, requiring less than 30 second on average to converge to a solution on a standard desktop computer.

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