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Applications of Spectral Sequences in Computing Derived Functors in Homological Algebra

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Abstract: *Spectral sequences are a fundamental computational tool in homological algebra, offering a systematic method to compute derived functors such as Ext and Tor, which are central to the study of modules, sheaves, and chain complexes. This review explores the theoretical background of spectral sequences, their construction from filtered complexes and double complexes, and highlights key applications in the computation of derived functors. Examples include the use of Grothendieck spectral sequences, Cartan–Eilenberg spectral sequences, and spectral sequences arising from exact couples.*

Keywords: Spectral sequences, derived functors, homological algebra