Asymptotic-preserving methods and differential algebraic equations
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Many applications involve PDEs with multiple space-time scales. Numerically resolving such scales may be computationally prohibitive and therefore one resorts on the use of some asymptotic analysis in order to derive reduced models which are valid in the small scales regime. The derivation of numerical schemes which are capable to describe correctly such asymptotic behavior without resolving the small scales has attracted a lot of attention in the recent years leading to the so-called asymptotic-preserving methods. In this talk we survey some of these techniques in the case of hyperbolic and kinetic PDEs and emphasize the close relationship with singular perturbed systems and differential algebraic equations.