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Title: Controllable Resonant Converters:
A Potential Key Technology for DC Power Systems

Abstract

Throughout the history of DC-DC power conversion research, resonant converters have consistently demonstrated high efficiency and compact size due to their inherent soft-switching capability. However, their commercial adoption remains limited, rarely replacing traditional topologies like buck or boost converters, primarily due to their limited controllability. Unlike conventional converters, resonant converters exhibit a highly nonlinear voltage response to operating frequency or duty cycle, which strongly depends on load conditions and hinders optimal controller design. Resolving this challenge is now crucial for future innovation. While the commercialization of next-generation power devices enables resonant converters to handle higher power at higher frequencies, modern high-power systems, such as AI datacenters, increasingly demand them to improve power density. To address this issue, this talk introduces a novel control approach that achieves linear control characteristics in resonant converters. Although some aspects of this concept have been independently explored by several research groups, its technical foundation and future vision remain poorly shared among engineers. This presentation aims to provide a comprehensive introduction to our development of highly controllable resonant converters.