

Nonlinear Control at the Edge of Instability

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The Problem & the Methodology

- Many complex engineered systems are stressed to the verge of instability. For example, smaller lighter weight aircraft engines need to power fighter aircraft by working at maximum capacity, and electric power networks need to deliver more power as demand increases.
- System failure can occur in these situations, leading to jumps and oscillations dictated by nonlinear effects (“bifurcations”).
- The bifurcation control methodology was developed at ISR to address these situations and has been applied broadly. It allows management of dynamics and prevention of instability.

The Applications

- The bifurcation control methodology has been applied by ISR and other researchers to yield new control techniques in the following applications:
 - Jet engine stall mitigation
 - Electric power systems
 - Communication networks
 - Power systems
 - Cardiac arrhythmia
 - Supercavitating torpedoes
 - Aircraft stall
- The ideas are also being applied by others in new areas such as neurological diseases.