

## Lyapunov function-based control of a DC/DC buck converter using Hybrid Systems formalism

**Luz Adriana Ocampo, Fabiola Angulo, David Angulo-Garcia**

*Abstract:* In this paper we propose a switched control strategy for the buck converter based on Lyapunov functions and the hybrid systems framework. First, we introduce the differential inclusion describing the dynamics of the buck converter in the hybrid systems formalism using the Krasovskii regularization. Then, a Lyapunov function is derived for the hybrid system, which naturally defines switching control surfaces that guarantee global stability of the system. With the aim of extending the degree of tuning of the Lyapunov-based switched control, we include a nonlinear term to the functions describing the switching manifolds, which preserves the stability features of the system allowing to further control transient behavior of the system. Finally, we show by means of numerical simulations that the proposed controller is robust to the switch position and can flexibly adjust the transient dynamics via a suitable selection of gains in the added nonlinear terms.

- 
- <sup>1)</sup> Luz Adriana Ocampo, M.Sc. (Ph.D. student): Universidad Nacional de Colombia, Sede Manizales, Campus La Nubia, Manizales, Colombia (CO), laocampona@unal.edu.co.
  - <sup>2)</sup> Fabiola Angulo, Professor: Universidad Nacional de Colombia - Sede Manizales, Facultad de Ingeniería y Arquitectura, Departamento de Ingeniería Eléctrica, Electrónica y Computación, Percepción y Control Inteligente, Bloque Q, Campus La Nubia, Manizales, 170003, Colombia (CO), fangulog@unal.edu.co.
  - <sup>3)</sup> David Angulo-Garcia, Associate Professor: Instituto de Matemáticas Aplicadas, Grupo de Modelado Computacional, Dinámica y Complejidad de Sistemas, Universidad de Cartagena, Carrera 6 No. 36 - 100. Cartagena, Colombia (CO), dangulog@unicartagena.edu.co.