

# SURVEY and REVIEW

Bernard Brogliato and Aneel Tanwani are the authors of “Dynamical Systems Coupled with Monotone Set-Valued Operators: Formalisms, Applications, Well-Posedness, and Stability,” the Survey and Review paper in this issue. To get a feeling for the problems being dealt with, the reader may have a look at the electrical circuit in Figure 4.1(c) (also shown on the cover). Kirchhoff’s voltage law yields  $L\dot{x} = -Rx + \lambda$ ;  $x$  is the current through the resistor, and  $L\dot{x}$ ,  $-Rx$  and  $\lambda$  are, respectively, the drops in voltage across the inductor, the resistor, and the diode. This would be a differential equation for  $x$  if  $\lambda$  were a known function of  $x$ , which it isn’t. For any  $\lambda > 0$ , i.e., whenever the voltage at the cathode is higher than at the anode, the (ideal) diode does not conduct, which implies that  $x$  coincides with the current  $i$  from the source. Therefore when  $x$  takes the value  $i$ , all we can say about  $\lambda$  is that it lies in the set  $(0, \infty)$ . We have encountered an equation of the general format studied in the paper:  $\dot{x} = f(t, x) + G(t, x)w$ ,  $x \in \mathbb{R}^n$ ,  $w \in \mathbb{R}^m$ , where  $w$  is required to belong to a set  $-\mathcal{F}(t, Hx, Jw)$  ( $G$ ,  $H$ , and  $J$  are matrices).

The diode circuit also illustrates the concept of complementarity: either the diode does not conduct ( $\lambda > 0$  and  $x - i = 0$ ) or it does, and then  $\lambda = 0$ ,  $x - i > 0$ . Similar complementarity problems are frequent in mechanics; a bouncing ball either has a positive height and gets no force from the floor or has zero height and then receives an upward reaction force. In addition to complementarity problems, the general format in the paper includes sweeping processes, maximal monotone differential equations, evolution inequalities, and additional related formalisms. The authors describe numerous applications to electrical circuits, mechanical systems, and other fields. With 592 references and five appendices that provide mathematical background, the article has much to offer those interested in an area that is certainly important in modeling.

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