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Networked Embedded Control Systems

If the first generation of control systems can be regarded as analog control, and the second generation as digital control, then we may be on the cusp of what could be called the third generation of control systems. Due to the rapid technological changes of the past decade, there is the possibility of deploying distributed control systems consisting of sensors and actuators connected by shared wired or wireless networks, and involving powerful computational nodes as well as software services.

We address the issue of how to facilitate the proliferation of such next generation control systems. We explore the issue of what are the appropriate abstractions and what is the matching architecture for the (re)convergence of control with communication and computation. We propose an abstraction of Virtual Collocation to be manufactured by the supporting middleware. We advocate a principle of local temporal autonomy for enhancing reliability. We provide an overview of efforts in the Convergence Laboratory at the University of Illinois.

Bio: P. R. Kumar is Franklin W. Woeltge Professor of Electrical and Computer Engineering, and a Research Professor in the Coordinated Science Laboratory, at the University of Illinois, Urbana-Champaign. He is a Fellow of the IEEE. He received the Donald P. Eckman Award of the American Automatic Control Council in 1985, and is the recipient of the 2006 IEEE Field Award in Control Systems. He is a coauthor of the book, *Stochastic Systems: Estimation, Identification and Adaptive Control*, with Pravin P. Varaiya. He has presented plenary lectures at conferences including the IEEE Conference on Decision and Control, the SIAM Conference on Optimization, the SIAM Annual Meeting, the German Open Conference on Probability and Statistics, International Workshop on Information Processing in Sensor Networks, INFORMS Telecommunication Conference, ACM SenSys, and the International Symposium on Information Theory. His current research interests are in wireless networks, sensor networks, and the convergence of control, communications and computation.