

*Averaging algorithms and distributed anonymous discrete function computation*

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Abstract: In distributed averaging and consensus algorithms, processors exchange and update certain values (or "estimates", or "opinions") by forming a local average with the values of their neighbors. Under suitable conditions, such algorithms converge to consensus (every processor ends up holding the same value) or even average-consensus (consensus is achieved on the average of the initial values held by the processors). We first review available convergence rate results. We then abstract the problem by introducing a model for deterministic distributed function computation by a network of identical and anonymous nodes. In this model, each node has bounded computation and storage capabilities that do not grow with the network size. Furthermore, each node only knows its neighbors, not the entire graph. Our goal is to characterize the class of functions that can be computed within this model. In our main result, we provide a necessary condition for computability which we show to be nearly sufficient, in the sense that every function that satisfies this condition can at least be approximated. The problem of computing (suitably rounded) averages in a distributed manner plays a central role in our development, and we provide an algorithm that solves it in time that grows quadratically with the size of the network. (Joint work with J. Hendrickx and A. Olshevsky.)

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John N. Tsitsiklis received the B.S. degree in Mathematics (1980), and the B.S. (1980), M.S. (1981) and Ph.D. (1984) degrees in Electrical Engineering, all from M.I.T., where he is currently a Clarence J Lebel Professor of Electrical Engineering. He has served as a co-director of the MIT Operations Research Center (2002-5), and is currently an associate director of the Laboratory of Information and Decision Systems.

His research interests are in the fields of systems, optimization, communications, control, and operations research. He has coauthored four books and several journal papers in these areas. His awards include an Outstanding Paper Award by the IEEE Control Systems Society (1986), the M.I.T. Edgerton Faculty Achievement Award (1989), the Bodossakis Foundation Prize (1995), and the INFORMS/CSTS prize (1997). He is a Fellow of IEEE and INFORMS, a member of the National Academy of Engineering, and has been a member of the National Council on Research and Technology in Greece. In 2008, he was conferred the title of Doctor honoris causa, from the Universite catholique de Louvain.