

## A novel N-input voting algorithm for X-by-wire fault-tolerant systems

### ABSTRACT

Voting is an important operation in multichannel computation paradigm and realization of ultrareliable and real-time control systems that arbitrates among the results of  $N$  redundant variants. These systems include  $N$ -modular redundant (NMR) hardware systems and diversely designed software systems based on  $N$ -version programming (NVP). Depending on the characteristics of the application and the type of selected voter, the voting algorithms can be implemented for either hardware or software systems. In this paper, a novel voting algorithm is introduced for real-time fault-tolerant control systems, appropriate for applications in which  $N$  is large. Then, its behavior has been software implemented in different scenarios of error-injection on the system inputs. The results of analyzed evaluations through plots and statistical computations have demonstrated that this novel algorithm does not have the limitations of some popular voting algorithms such as median and weighted; moreover, it is able to significantly increase the reliability and availability of the system in the best case to 2489.7% and 626.74%, respectively, and in the worst case to 3.84% and 1.55%, respectively.

**Keyword:** Novel voting algorithm; Real-time fault-tolerant