

What's $Z-X$, when $Z = X+Y$?
Dependency tracking in interval arithmetic with bivariate sets

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Abstract

In this paper we propose an extension to interval arithmetic to include arithmetic with bivariate sets, which allows for an initial dependency to be propagated, as well as the tracking of complicated dependencies arising from repeated variables. These bivariate sets are represented by Boolean fields which define where two intervals jointly exist or not. We name this extended interval arithmetic *zone arithmetic*. We show how conditional sets may be constructed from bivariate intervals, and how dependent interval arithmetic may be performed with this conditioning. With conditioning we calculate the dependencies between the inputs and outputs of operations, allowing for the extra uncertainty from repeated variables to be greatly reduced. Recent work on using copulas to perform similar calculations with p-boxes is also reviewed.