A new technique is proposed for fault-tolerant linear, sesquilinear and bijective (LSB) operations on M integer data streams ($M \geq 3$), such as: scaling, additions/subtractions, inner or outer vector products, permutations and convolutions. In the proposed method, M input integer data streams are linearly superimposed to form M numerically-entangled integer data streams that are stored in-place of the original inputs. LSB operations can then be performed directly using these entangled data streams. The results are extracted from the M entangled output streams by additions and arithmetic shifts. Any soft errors affecting one disentangled output stream are guaranteed to be detectable via a post-computation reliability check. Additionally, when utilizing a separate processor core for each stream, our approach can recover all outputs after any single fail-stop failure. Importantly, unlike algorithm-based fault tolerance (ABFT) methods, the number of operations required for the entire process is linearly related to the number of inputs and does not depend on the complexity of the performed LSB operations. We have validated our proposal in an Intel processor via several types of operations: fast Fourier transforms, convolutions, and matrix multiplication operations. Our analysis and experiments reveal that the proposed approach incurs between 0.03% to 7% reduction in processing throughput for numerous LSB operations. This overhead is 5 to 1000 times smaller than that of the equivalent ABFT method that uses a checksum stream. Thus, our proposal can be used in fault-generating processor hardware or safety-critical applications, where high reliability is required without the cost of ABFT or modular redundancy.