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Implementation of Floating Point Arithmetics with Accurate Rounding to the Two Body Problem

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A double-precision format can be used easily for single-precision computa- tions, while for double-precision computations, extended or higher precision may not be enough in some formats such as binary64 in IEEE 754-2008 standard. In this study, by using floating-point arithmetics, the required algorithms to solve the N-body problem more accurately than ordinary computations have been researched. The pair-precision technique has been used for representing the exact number and pairs are the representation of double type as a sum of two double variables. The chosen mathematical approaches for algorithms are particularly based on the type of series used. Therefore, it was identified that if the series is absolute convergent, the order of operations needs to be inverted. As expected, the results for ordinary and arithmetic operation calculations were acquired to be less than half the machine epsilon which is the maximum relative error of the rounding mode in effect.

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