An Efficient Method Of Applying Accurate Summation Algorithms To 3D Orientation Problem

Katsuhisa Ozaki

WASEDA UNIVERSITY, JAPAN k_ozaki@aoni.waseda.jp

This talk is concerned with the orientation problem, which is one of the basic problems in computational geometry. This problem can be boiled down to the determinant predicate, i.e. whether the sign of the determinant is positive, negative or zero.

Especially in this talk, we focus our mind on 3D orientation problem. It is known that the computation of the determinant can be transformed into that of a summation without rounding errors by applying so-called "error-free transformation" to floating-point operations. In case of the 3D orientation problem, we obtain a vector of 96 or 192 floating-point numbers for the summation. We remark that there are several ways to obtain the vector. By considering the distribution of the order of magnitude between the elements of the vector, we propose a fast and efficient method of predicating the sign of determinant. Finally, we present numerical examples in order to confirm effectiveness of the proposed method.

This is a joint work in Takeshi Ogita (CREST / Waseda University), Siegfried M. Rump (Hamburg University of Technology) and Shin'ichi Oishi (Waseda University)