Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

A new approach to: (a) grid generation for numerical optimization, and (b) interconnect networks for beowulf clusters, leveraging n-dimensional sphere-packings THOMAS BEWLEY, JOSEPH CESSNA, PAUL BELITZ, UC San Diego — The abstract field of n-dimensional sphere packing theory is well developed (for a comprehensive review, see Sphere Packings, Lattices and Groups by Conway and Sloane). This theory forms the theoretical underpinning of the error-correcting codes used in both deep space communications and in computer memory. The present work extends this elegant theory to two important and immensely practical problems in computational fluid dynamics: (a) the generation of efficient grids for the coordination of grid-based derivative-free optimization algorithms in n dimensions, and (b) the effective n-dimensional interconnection of massively-parallel clusters of computational nodes. As we will illustrate and quantify, the first problem benefits tremendously from dense sphere packings with large kissing numbers >> 2n, whereas the latter problem benefits tremendously from rare sphere packings with kissing number = n+1.

Christopher Colburn
UC San Diego

Date submitted: 06 Aug 2008 Electronic form version 1.4