1086-65-2035 **Andrew Gillette*** (akgillette@mail.ucsd.edu), Department of Mathematics, UC San Diego, 9500 Gilman Drive MC 0112, La Jolla, CA 92093. *Geometric Decomposition of Serendipity Finite Element Spaces.*

I will first introduce new Hermite-style and Bernstein-style geometric decompositions of the cubic order serendipity finite element spaces $\mathcal{S}_3(I^2)$ and $\mathcal{S}_3(I^3)$, as defined in the recent work of Arnold and Awanou [*Found. Comput. Math.* **11** (2011), 337–344]. The cubic serendipity spaces are substantially smaller in dimension than the more commonly used tensor product spaces - 12 instead of 20 for the square and 32 instead of 64 for the cube - yet are still guaranteed to obtain cubic order *a priori* error estimates when used in finite element methods. The basis functions in these new decompositions have a number of nice properties, including canonical relationships to the finite element degrees of freedom and to the geometry of their graphs. I will conclude by showing how this approach for cubics can be extended to construct decompositions for both higher polynomial order and higher form order serendipity spaces. (Received September 24, 2012)