1142-14-94 **Samantha Sherman*** (ssherma1@nd.edu) and **Tamara G. Kolda**. *Implicit decomposition of symmetric tensors corresponding to higher-order moments.*

There has lately been interest in tensor decompositions of symmetric tensors that correspond to higher-order moments. These represent mixture models and have applications in signal separation and data analysis. Given a set of p observations of length n, the dth order moment is formed as follows. For each observation, form its d-way outer product, and then sum the d-way outer products for all p observations. Forming this explicitly requires n^d space and $O(pn^d)$ floating point operations (flops). Instead, we show that the moment tensor can be decomposed using only the original $n \times p$ observation matrix, reducing the total space to $O(np)$ and the number of flops to $O(pnr)$. Numerical results confirm our analyses: the implicit method produces the same results as the explicit method and is significantly faster. In fact, the implicit method can solve problems that are prohibitively expensive in the explicit case. (Received August 30, 2018)