SXSVD: South by SVD
Gene H. Golub’s World Day Celebration

Friday, February 29
2:00-8:00pm
A.C.E.S. Building

Student Poster Session
with Catered Lunch
2:00-2:45pm A.C.E.S. Atrium

Science & Memories
with a Birthday Cake
3:00-7:15pm A.C.E.S. 2.402
Speakers include: Bjorn Engquist,
Omar Ghattas, Thomas J. Hughes and Orly Alter

CALCULATING THE SINGULAR VALUES AND PSEUDO-INVERSE
OF A MATRIX*

G. GOLUB† AND W. KAHAŇ‡

Abstract. A numerically stable and fairly fast scheme is described to compute the
unitary matrices $U$ and $V$ which transform a given matrix $A$ into a diagonal form
$A = U^*AV$, thus exhibiting $A$’s singular values on $\Sigma$’s diagonal. The scheme first
transforms $A$ to a bidiagonal matrix $J$, then diagonalizes $J$. The scheme described
here is complicated but does not suffer from the computational difficulties which
occasionally afflict some previously known methods. Some applications are men-
tioned, in particular the use of the pseudo-inverse $A^\dagger = V\Sigma^*U^*$ to solve least squares
problems in a way which dampens spurious oscillation and cancellation.