Munich University of Applied Sciences, FK06
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Course mbd WS 2010

Problem 1: Math Tutorial - use e.g. Maple
Vector and Matrix Calculations and Derivatives

Given are the vectors:
a := (2, -3, 5)^T: b := (-4, 1, 6)^T: c := (3, 4, -5)^T:
Solve the following problems:

a) Magnitude and unit vectors

b) Scalar product of μ = (a b) and (a c)

c) Cross product of (a b) = d

d) Calculations with Tilde-operator:
    v=ω~r, ω~ω, ω~ω~ where r=(r1,r2,r3)^T, ω=(ω1,ω2,ω3)^T, use a Tilde procedure

e) Further calculations with Tilde-operator: (a~ b)~ ,   a~ b~,   d = a~ b~ c, μ= a^T b~ c, use given data above.

f) Matrix calculations: D = A.B.C, use the following data for the matrices.:

$$A := \begin{bmatrix} 1 & 10 & -32 \\ -10 & 1 & 23 \\ 32 & -23 & 1 \end{bmatrix} \quad B := \begin{bmatrix} -25 & 12 & -20 \\ 2 & -20 & 5 \\ 12 & -18 & 13 \end{bmatrix} \quad C := \begin{bmatrix} 1 & 2 & 3 \\ -4 & 5 & -6 \\ 7 & 8 & 9 \end{bmatrix}$$

    Calculate D, D^T, D^-1, and (D^-1)^T and check the correctness of Eqs. (N6.3,4,5)

g) Find derivatives of $f = k \tan(\sqrt{\phi})^2$ w.r.t. time t, where $\phi = \phi(t)$:
    $\dot{f}$ = fdot , $\ddot{f}$ = fdotdot, $\dddot{f}$ = fdotdotdot

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Tilde Procedure for Maple:

Tilde := proc(v)
    description "Tilde matrix";
    Matrix([[0, -v[3], v[2]], [v[3], 0, -v[1]], [-v[2], v[1], 0]])
end proc: