

Mathematical modelling, Exam 3

22. 8. 2019

- Construct any non-diagonal 3×2 matrix A whose singular values are 2 and 1.
 - Find the Moore-Penrose inverse A^+ .
 - Let $b \in \mathbb{R}^2$. Describe the property uniquely characterizing point $A^+ \cdot b$ with respect to the system $Ax = b$.

- Two surfaces in the upper halfspace $z > 0$ are given by the following equations:

$$\Pi : x^2 + y^2 = \frac{z^2}{2} \quad \Sigma : x^2 + y^2 = z.$$

Curve γ is the intersection of surfaces Π and Σ . Let $P = (1, 1, 2) \in \gamma$.

- Find the angle at which the surfaces intersect at P .
 - Find the line tangent to γ at P .
 - Find the plane that is tangent to Σ at $(1, 2, 5)$.
- Solve the following exact differential equation $2xy + (x^2 + 3y^2)y' = 0$.
 - Solve the differential equation $y'' + 9y = 2x^2 - 1$. with the initial condition $y(0) = y'(0) = 1$.