

ASEN 5005-Statistical Orbit Determination

Homework 4

Zach Dischner

9/24/2012

1 Problem 1

Given the joint density function:

$$\begin{aligned} f(x, y) &= k * (x^2 + y^2) & 0 < x < 2, \quad 1 \leq y \leq 3 \\ f(x, y) &= 0 & elsewhere \end{aligned}$$

Several insights were to be found.

1.1 1a-Find k

To find **k**, I employed the rule that any joint density function must be equal to one when integrated across the number range.

$$\int_{-\infty}^{\infty} \int_{-\infty}^{\infty} k * (x^2 + y^2) dx dy = 1 \quad (1)$$

Since the validity of the function was limited to a specific number range for each variable, the joint density function becomes:

$$\int_1^3 \int_0^2 k * (x^2 + y^2) dx dy = 1 \quad (2)$$

First, I integrated with respect to **x**

$$k * \int_1^3 \left(\frac{x^3}{3} + x * y^2 \right) \Big|_0^2 dy = 1 \quad (3)$$

Then after evaluating for the **x** range, I integrated with respect to **y**

$$k * \left[y * \frac{8}{3} + 2 * \frac{y^3}{3} \right] \Big|_1^3 dy = 1 \quad (4)$$

Which evaluates down to

$$k * [22.67] = 1 \quad (5)$$

Yielding a final value of

$$k = 0.0441 \tag{6}$$

Cool, this is working alright.