Assignment 7

Read the assignment carefully! Remember that the first line of a script must be the call to the script preamble.

A. Mandatory

The script Assignment07A_IDxx.m[1] solves the following three problems. Put each item in a separate section!

1. The ellipse $\mathcal{E}$ in the x/y-plane is defined by the equation

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1. \tag{1}$$

   Set $a = 5,\ b = 3$; compute and display the numerical approximation of the line integral[2] of the function $f(x, y) = \cos(xy)$ along $\mathcal{E}$. *(2 pt)*

   ➽ Use the standard parametric representation[3] of the ellipse equation in (1) and compute the differential ds of the arc length by symbolic operations.

2. Compute and display *both* the symbolic value *and* the numerical approximation of the double integral in Cartesian coordinates of the function $g(x, y) = x^2 + y^2$ over the region bounded by $\mathcal{E}$. Show also the relative error of the numerical approximation. The integration limits in y must be determined by symbolical computation. No hard-coding! *(2 pt)*

   ➽ Do not call preamble during code development, as the symbolic integration is rather slow if you start with a cleared workspace.

3. Same as 2., but with symbolic and numerical integration in polar coordinates r, φ defined by: *(2 pt)*

$$x = a\, r \cos\varphi,\ \ y = b\, r \sin\varphi.$$

   Determine the Jacobian determinant[4] of the coordinate transformation by symbolic operations.

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[1] xx is your (group's) ID number
[2] https://en.wikipedia.org/wiki/Line_integral
[3] https://en.wikipedia.org/wiki/Ellipse#Standard_parametric_representation
[4] https://en.wikipedia.org/wiki/Jacobian_matrix_and_determinant

B. Optional

The script Assignment07B_IDxx.m[5] computes and displays the numerical approximation of the volume integral of the function $h(x, y, z) = x^2 + y^2 + z^2$ in the elliptic cone[6] with apex $0/0/c$ over $\mathcal{E}$. Determine the upper integration limit in z by symbolical operations, then set $c = 6$. No hard-coding! *(2 pt)*

➽ **Make sure that the relevant results and *only* those are shown in the output to the command window. Submit the script(s) until 5pm on May 19, 2021. Don't forget to put your partner in cc! Any violation of the naming convention will lead to the rejection of the submission.**

[5] xx is your (group's) ID number
[6] https://en.wikipedia.org/wiki/Cone#Elliptic_cone