

UNIVERSITÄT DES SAARLANDES  
LEHRSTUHL FÜR COMPUTER GRAPHIK  
PROF. DR. PHILIPP SLUSALLEK,  
PROF. DR. HAB. INŻ. KAROL MYSZKOWSKI (MPII), AND  
DR. GURPRIT SINGH (MPII)  
TUTORS: DUARTE DAVID AND  
PASCAL GRITTMANN



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## REALISTIC IMAGE SYNTHESIS (SS 2020) ASSIGNMENT 3

**Submission deadline for the exercises: 4 June 2020**

### 3.1 Sampling a cylinder (40 points)

Given points  $(x_i, y_i)$ , uniformly distributed on the unit square  $[0, 1] \times [0, 1]$ , derive a formula for generating points  $P(x_i, y_i) \in \mathbb{R}^3$  uniformly distributed on the surface of a cylinder consisting of 2 caps and the cylinder body. The centers of the bases of the cylinder are at  $(0, 0, 0)^T$  and  $(0, 0, h)^T$  and each has radius  $r$ . Argue why the transformation gives the same (constant) density for each point on the surface of the cylinder.

### 3.2 Variance (20 points)

Given is the integral:

$$G = \int_0^1 \cos\left(\frac{\pi x}{2}\right) dx.$$

Straightforward Monte Carlo method sampling uniformly on  $(0, 1)$  will form the estimator:

$$g = \cos\left(\frac{\pi x}{2}\right).$$

Show that the analytical evaluation of the variance results in  $\text{var}(g) \approx 0.0947$ .

## Procedure of Submitting

Please submit your solutions in .pdf format via email to the tutor: s8dudavi@stud.uni-saarland.de  
The submission deadline is midnight, i.e., 4 June 2020 , 23:59. Late submissions within 24 hours will receive at most 75% of the points. Late submissions after more than 24 hours will not be accepted.