



Biological and Medical Fluid Mechanics I

Overview and general remarks

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Schedule

- 04.04.2019 lecture / exercise
- 11.04.2019 lecture / exercise
- 18.04.2019 lecture / exercise
- 25.04.2019 lecture / exercise
- 02.05.2019 lecture / exercise
- 09.05.2019 lecture / exercise
- 16.05.2019 lecture / exercise
- 23.05.2019 lecture / exercise
- 30.05.2019 Ascension day (Father's day)
- 06.06.2019 lecture / exercise
- 13.06.2018 excursion week (Pentecost)
- 20.06.2018 Corpus Christi
- 27.06.2018 lecture / exercise
- 04.07.2018 lecture / exercise
- 11.07.2018 lecture / exercise

General Information

- Lecture/exercise room
 - Room 301, Institute of Aerodynamics (building 1260)
- Exercises:
 - depending on the state of the lectures
 - during lecture according to agreement
- Exam
 - BMS I: September 18th 2019 /// BMS II: September 19th 2019
 - oral exams in small groups (2 students), duration: approx. 30-35 min per group
 - Place: Room 209, Institute of Aerodynamics (building 1260)
 - Schedule will be published approx. one week before the exam
- Prerequisites
 - Required: Fluid Mechanics I
 - Recommended: Fluid Mechanics II
- L2p:
 - Lecture slides
 - Announcements, schedule of the exam

Lecture contents

| 1. Introduction | Exercise |
|--|----------|
| 1.1 Transportation processes in the human body <ul style="list-style-type: none">1.1.1 Exchange of respiratory gases1.1.2 Blood circulation1.1.3 Other transportation processes | |
| 1.2 Transportation processes in medical devices | |
| 1.3 Tasks of fluid mechanics in medicine | |
| 1.4 Examples of application <ul style="list-style-type: none">1.4.1 Computer assisted surgery of the nose1.4.2 Examination of the airway flow1.4.3 Investigation of an artificial heart valve1.4.4 Silent flight of the owl | |

Lecture contents

| 2. Blood as a transport medium | Exercise |
|--|----------|
| 2.1 Tasks, composition and distribution 2.1.1 Tasks 2.1.2 Composition and distribution 2.1.3 Blood volumes | |
| 2.2 Red Blood Cells (RBC): erythrocytes 2.2.1 Shape and hematocrit 2.2.2 The red blood dye 2.2.3 The membrane of RBC 2.2.4 Decomposition | |

Lecture contents

| 3. Rheology of blood | Exercise |
|---|----------|
| 3.1 Classification of blood <ul style="list-style-type: none">3.1.1 Definitions3.1.2 Flow behavior of suspensions3.1.3 Blood as a suspension of flexible particles | |
| 3.2 Viscosity of blood <ul style="list-style-type: none">3.2.1 Viscosity measurement methods3.2.2 Viscosity models for blood plasma and whole blood3.2.3 Influences on the viscosity of blood | |
| 3.3 Non-Newtonian blood analog fluid <ul style="list-style-type: none">3.3.1 Requirements and composition3.3.2 Xanthan gum3.3.3 Influence of temperature | |

Lecture contents

| 4. Blood damage | Exercise |
|--|----------|
| 4.1 Hemolysis <ul style="list-style-type: none">4.1.1 General remarks4.1.2 Forms of hemolysis4.1.3 Blood damage due to flow phenomena4.1.4 Measurement of hemolysis | |

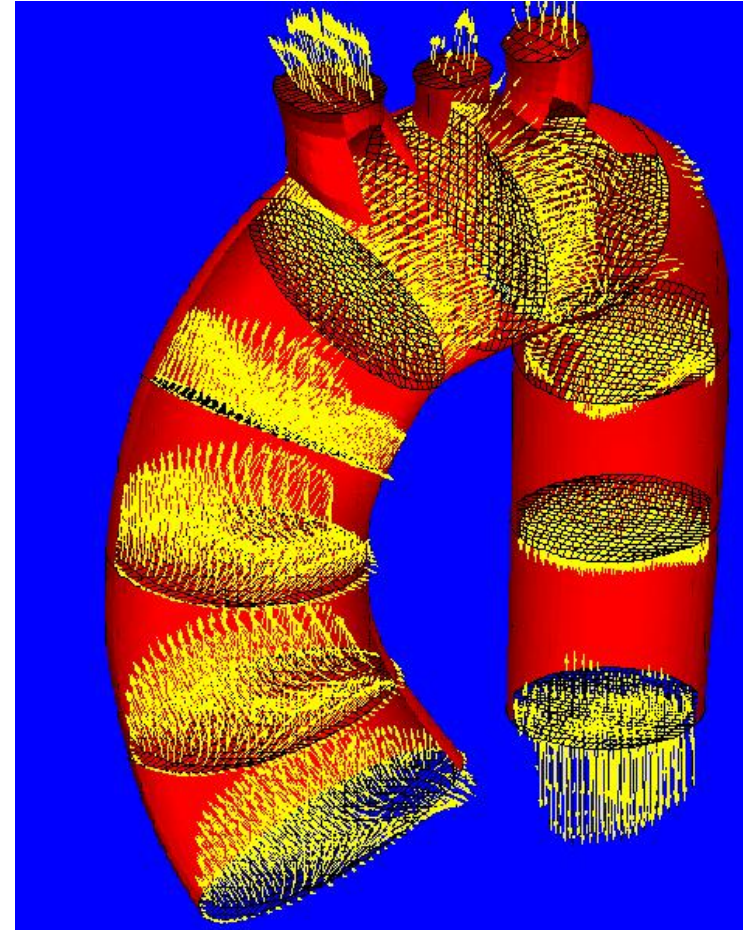
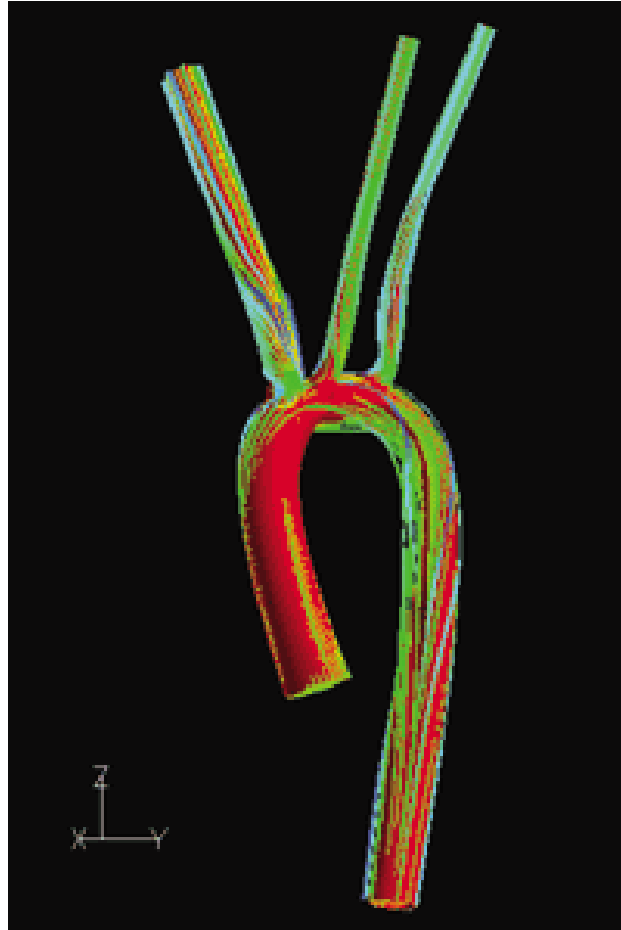
Lecture contents

| 5. The cardiovascular system: the heart | Exercise |
|---|----------|
| 5.1 The heart <ul style="list-style-type: none">5.1.1 Tasks and supply of the heart5.1.2 Volume and pressure in the heart during heart contraction5.1.3 Important heart measurements and their normal values5.1.4 Regulation mechanisms of the heart | |

Lecture contents

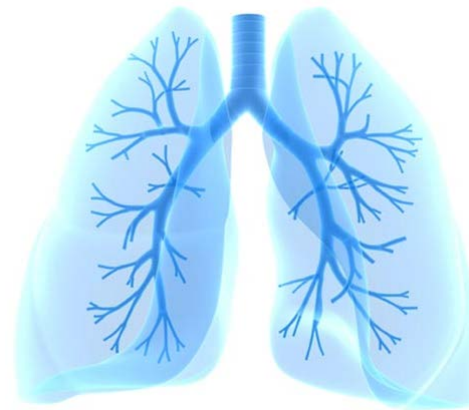
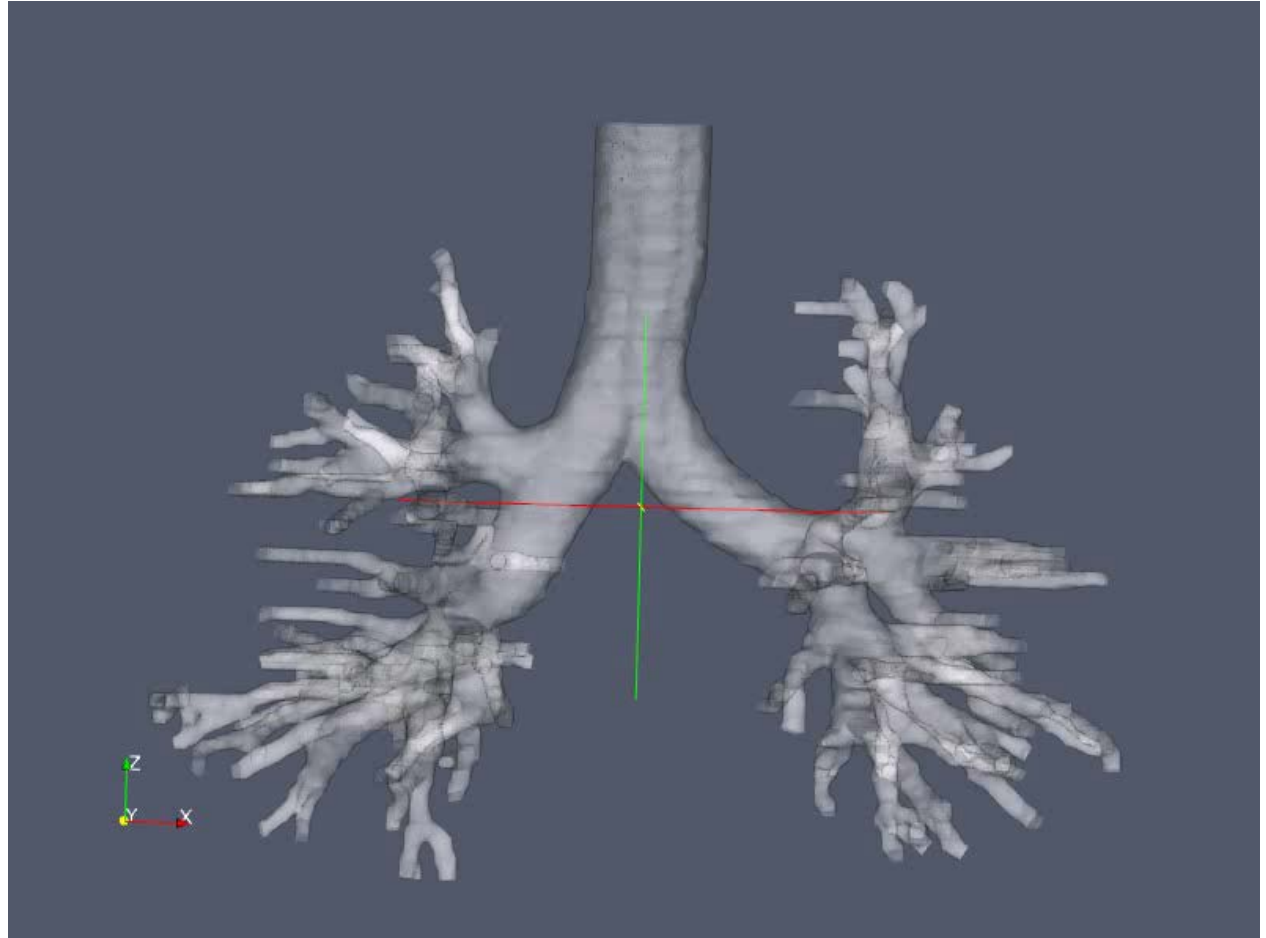
| 6. The respiratory system: the lungs | Exercise |
|--|----------|
| 6.1 Physical and Physiological Description | |
| 6.2 Exchange Mechanisms | |
| 6.3 Pressure-Volume-Diagram of the lungs | |
| 6.4 Flow structures in the lungs | |
| 6.5 Branch flow | |

Examples of Biological and Medical Fluid Mechanics: Aorta

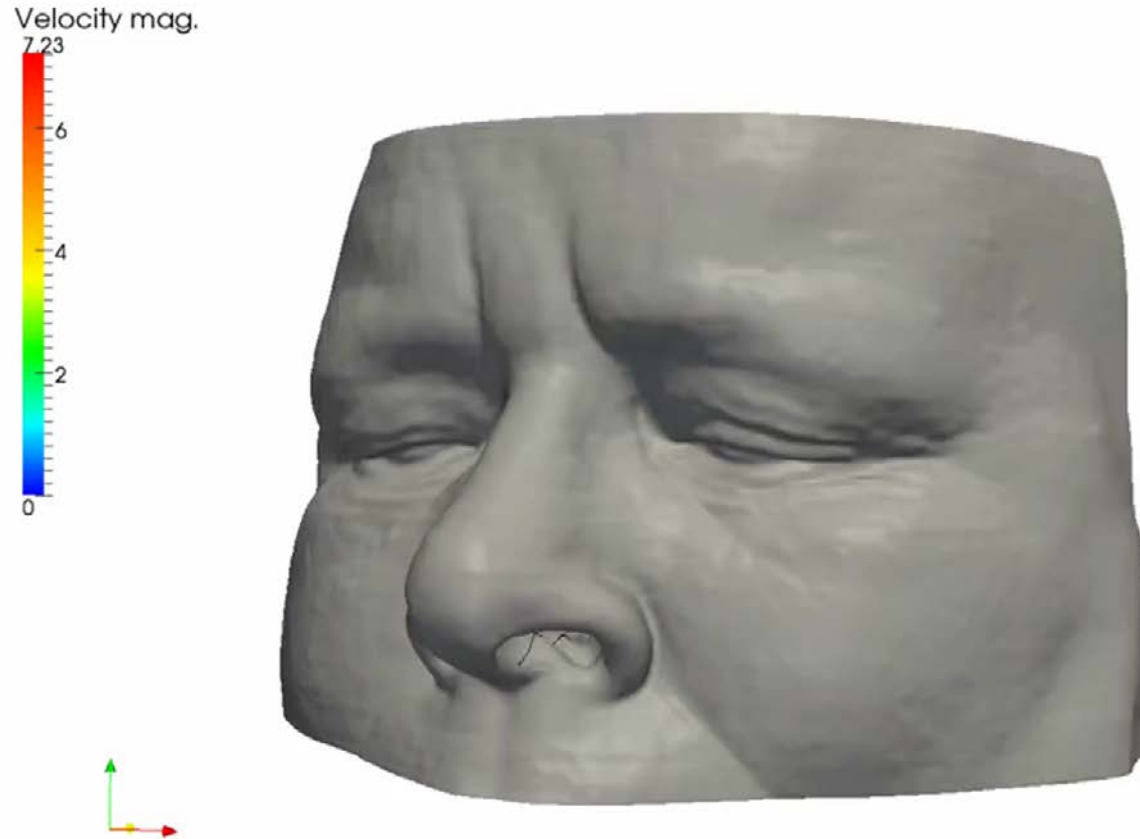


Examples of Biological and Medical Fluid Mechanics:

Respiratory flow in the lungs

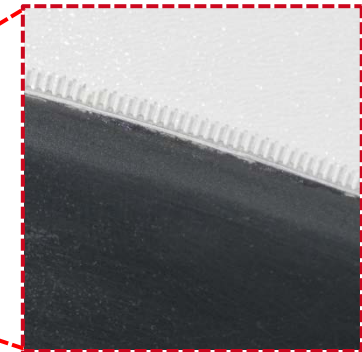


Examples of Biological and Medical Fluid Mechanics: Respiratory flow through the nose



Examples of Biological and Medical Fluid Mechanics:

Owl wing



Thank you for your attention!