

Modulbezeichnung "Mobile Systeme in Natur und Technik 2"
("Mobile Systems in Nature and Technology 2")

Module code	2.1
-------------	-----

Semester 2. Semester MSc

Module coordinator Prof. Dr. Eize J. Stamhuis

Qualification objectives
Widening and deepening of knowledge of animal functional morphology. Ability to interpret structures towards proposed functions, to formulate hypotheses and find abstractions of 'design' towards applications. Essence derivation of literature sources. Understanding and discussing advanced concepts. Familiarization with theoretical and practical background of appropriate measurement equipment. Skills in deduction of principles from individual examples.

Module Content
Animal Locomotion 2:
Undulatory swimming in fish: adaptations, functional morphology & body plan, muscular design, linking body and fluid motion, wake development.
Scaling and Re in aerial locomotion; evolution of flight, insect wing design and body plan in relation to insect group, body structure and function, direct & indirect flight muscles, flight control; Quasi-flying vertebrate flight styles; Bat body plan, wing design, flight phases; Bird body plan, functional muscle architecture, feathers, wing shape parameters, stall characteristics, unsteady effects in rel. to wing design, basic wing shapes, gliding vs. flapping flight, function of unsteady aerodynamics vs. flight phase. Linking of Motion and Control to formalisation and simplification for Biomimetic applications.

Biomechanics 2:
Vortices; Helmholtz theorem; Lift vs. airfoil shape; Gliding and soaring; Thrust of flying and swimming; Unsteady flows; Fluid-fluid-interfaces; Effect of total wing design parameters; Magnus-effect; Prandtl's lifting line theory; Kutta-Jakowski-theorem; Wagner effect; Clap-and-fling mechanism; Delayed stall and leading-edge vortices; Kramer-effect; Wing-wake interaction; Unsteady aerodynamics in birds and bats. Wind tunnel design; Visualisation of air flow phenomena; Quantifying air flow phenomena (LDA, DPIV); Wind/water-tunnel balance systems; Calculating forces from flow analysis: wake-integration, down-wash integration, vortex-ring models.

Type of module Compulsory Module

Teaching and learning methods Seminar instruction, self-study based on literature, presentation (in English) based on literature, Class discussions.

Assessment Written examination 90 mins (Short presentation: 15 mins)*

Pre-requisites recommended: Basic knowledge of Biology and Mechanics, Mobile Systems in Nature and Technology 1

Usability	Advanced level Choice-module for e.g. Biology, Science or Engineering; Adv. BSc or MSc
Student workload	60 + 120 h
Contact hours	60 h
Independent study	120 h
ECTS points	6
Duration and frequency	One time per academic year in Summer-semester 15 scheduled lectures
Language	English
Reading list	Will be announced at the semester start.

Lecturer	Subject	SWS
Prof. Dr. Stamhuis	Biomechanics 2	2
Prof. Dr. Stamhuis	Animal Locomotion 2	2

*: Studienleistung, unbenotet