UnB Faculdade UnB Gama

A UnB quem faz é a gente

COURSE PLAN 2021/1

REMOTE DISCIPLINE

Associate Professor:

Suélia S. R. F. Rosa – Electric Engineer – suelia@unb.br

Ronni G. G. Amorim – Theoretical Physicist – ronniamorim@unb.br

Schedule: Wednesday 18:00 às 22:00

Plataforma de Ensino: https://teams.microsoft.com/

Open channels: WhatsApp – PPG_Course

Chat Teams Team

E-mail

COURSE: The introduction to the dynamic modelling techniques used in contemporary research in Biomedical Engineering and Bioengineering will be studied. The course is suitable for advanced graduate students, with a defined theme and orientation. Mathematical modelling is a tool that involves the use of calculations and software development. The classes will provide a basis for developing mathematical models using: i) Bond Graph Technical (by Profa. Suelia Fleury)l and ii) Fractional Calculus Applied to Biomedical Engineering (by Prof. Ronni). The course will promote in the student a knowledge of computer modelling to better analyse their research question.

APPOINTMENT:

1) Synchronous meetings at the times established by the discipline with a new agenda discussed with the students (Following tools will be used: The chanel of PPGEB in Youtube (https://www.youtube.com/channel/UCrlUsSmL0izxC6rcAwMGZMg) MicrosoftTeams; Whatssap, Moodle Plataform).

2) Guarantee of Access to Teachers via WhatsApp for Monitoring; Clarification of Doubts and Assistance; Receiving Difficulty Reports linked to the technology and internet variable.

3) Final Evaluation of the Discipline, by the Students, - as a way of verifying the quality taught by the teacher.

4) Flexibility to the deadlines for carrying out activities, following the agenda built with the class.

5) Communicate and provide feedback to students and the institution - for Coordination.

6) Ensure that all material used in the classroom, books and academic content is made available to students without prejudice and with equity.

7) There will be no printing of material, all activities will be done in a virtual or manual or digital way, without the need for printing.

8) Clearly define the tasks, deadlines, and delivery method.

9) Guarantee individual feedback - with private discussions - if necessary.

10) Checking for plagiarism using tools https://www.turnitin.com/ that provide feedback.

GENERAL PROGRAM

The program will be divided in two parts,

Part 1 by Professor Suelia Fleury – **Overview of Systems Biology and Biotechnology** Simulation and Modeling of natural. **Introduction to System Dynamics**. System Decomposition and Model Complexity. Mathematical Modeling of Dynamic Systems. Analysis and Design of Dynamic Systems. Control of Dynamic Systems. Diagrams of Dynamic Systems. A Graph-Centered Approach to Modeling. **Basic Bond Graph Elements.** Introduction. Power and Energy Variables. Basic 1-Port Elements. Basic 2-Ports Elements. Junction Elements. Simple Bond Graph Examples**. Bond Graph Synthesis and Equation Derivation.** Introduction. General Guidelines. Mechanical Translation. Mechanical Rotation. Electrical Circuits. Hydraulic Circuits. Mixed Systems. State Equation Derivation. State-Space Representations. Algebraic Loops and Derivative Causality. Bond Graph applied in Biology Systems. We'll be using the MATLAB programming environment.

Part 2 by Prof Ronni – Fractional Calculus Applied to Biomedical Engineering: - Historical aspects of fractional calculus. – Fundamental Tools: Gamma and Beta functions; Laplace Transform; Mittag-Leffler functions; Glefand-Shilov function. – Fractional Integral: Kinds of fractional integrals; Riemann-Liouville fractional integral; Properties of Riemann-Liouville fractional integral. – Fractional Derivative: Definitions; Riemann-Liouville fractional derivative; Caputo fractional derivative; Properties of Caputo Fractional Derivative. – Fractional Differential Equations: Definitions; elementary fractional differential equations. – Applications of Fractional Calculus in Biomedical Engineering: study of case using fractional logistic equation.

TEACHING METHODOLOGY

(X) Use of Youtube Video

(X) Use of Quis, Google and APP Systems (Nearpod - ThingLink)

(X) Use of TED Talks Video

(X) Use of discussion seminars

(X) Use WhatsApp

(X) Teams - camera on and frequency counted, time that must be present in the virtual mode at least 80% of the total time of the lesson, recorded lesson.

(X) Use of extra-class material

(X) Extended Summary Writing

(X) Digital Material Generation - drawings, graphs and analyses.

CONDITIONS FOR APPROVAL:

The grades will be counted in each activity that is scored - the students received partial grades every 3 weeks for personal control of their progress. Review the material we'll cover each week, and preview the assignments you'll need to complete to pass the course.

NA - theoretical and practical assessments - individual and group.

NAF is a simple average of the evaluation scores.

NE - extra-class and class activity to be carried out - individual and group.

NEF is a simple average of activity scores.

AL = simple mean of NAF and NEF.

THE STUDENT WILL BE CONSIDERED APPROVED if AL ≥ 5.0

THE STUDENT WILL BE CONSIDERED FAILED if AL < 5.0.

Omitted cases - and not mentioned in this plan will be dealt with according to the University's by laws. Please if doubt you should be to consult:

http://saa.unb.br/images/stories/documentos/calendarios/graduacao/cal_atividades/Graduacao_2021_1.pdf

Week/Lectures/Professor

	Subject	**Part 1 and Part 2**
Open Class July 26th	Course Information, Program. Overview of Systems Biology and Biotechnology Simulation.	**Virtual classroom:** Lecture 1 **After classroom:** Assignment 1 **Supplementary Files:** Computing with MATLAB; OPENCADD https://www.youtube.com/c/Opencadd/playlists; MATLAB https://www.youtube.com/user/MATLAB Read - Plenitude e Completude de Fazer Ciência
August 2nd	Introduction to System Dynamics. System Decomposition and Model Complexity. Mathematical Modeling of Dynamic Systems. Analysis and Design of Dynamic Systems	**Before classroom:** RESEARCH ARTICLE 1 https://www.youtube.com/watch?v=k1wjyjFpwPc **Virtual classroom:** Part 1 with Prof Fleury **After classroom:** Assignment 2 **Supplementary Files:** Computing with MATLAB; and Read Paper Read: Novas tecnologias aplicadas à saúde: integração de áreas transformando a Sociedade.”
August 9th		**Before classroom:** **Virtual classroom:**

		After classroom: **Supplementary Files:**
August 16th	Control of Dynamic Systems. Diagrams of Dynamic Systems. A Graph-Centered Approach to Modeling. Basic Bond Graph Elements. Introduction. Power and Energy Variables. Basic 1-Port Elements.	**Before classroom:** Read Text Chapter-(Text Book) **Virtual classroom:** Part 1 with Prof Fleury **After classroom:** Assignment 3 **Supplementary Files:** Computing with MATLAB; and Read Paper. Read: " Novas tecnologias aplicadas à saúde: integração de áreas transformando a Sociedade."
August 23th		**Before classroom:** **Virtual classroom:** **After classroom:** **Supplementary Files:**
August 30th	Basic 2-Ports Elements. Junction Elements. Simple Bond Graph Examples General Guidelines. Mechanical Translation. Mechanical Rotation.	**Before classroom:** Read Text Chapter-(Text Book) - RESEARCH ARTICLE 2 **Virtual classroom:** Part 1 with Prof Fleury **After classroom:** Assignment 4 **Supplementary Files:** Recording video with discussion Read Novas tecnologias aplicadas à saúde: desenvolvimento de Sistemas Dinâmicos - Conceitos, aplicações e utilização de técnicas inteligentes e regulação
September 6th	Avaliação?	
September 13th	Electrical Circuits. Hydraulic Circuits. Mixed Systems.State Equation Derivation. State-Space Representations.	**Before classroom:** Read Text Chapter- (Text Book) **Virtual classroom:** Part 1 with Prof Fleury **After classroom:** Implementation's **Supplementary Files:** Recording video with discussion Read Novas tecnologias aplicadas à saúde: desenvolvimento de Sistemas Dinâmicos - Conceitos, aplicações e utilização de técnicas inteligentes e regulação
September 20th		**Before classroom:** **Virtual classroom:** **After classroom:** **Supplementary Files:**
September 27th	Algebraic Loops and Derivative Causality. Bond Graph applied in Biology Systems.	**Before classroom:** Read Text Chapter-(Text Book) - RESEARCH ARTICLE 3 **Virtual classroom:** Part 1 with Prof Fleury

		After classroom: Analysis **Supplementary Files:** Recording video with discussion
October 4th		**Before classroom:** **Virtual classroom:** **After classroom:** **Supplementary Files:**
October 11th	Bond Graph applied in Biology Systems.	**Before classroom:** Write brief **-** RESEARCH ARTICLE 4 **Virtual classroom:** Part 1 with Prof Fleury **After classroom:** Review other students brief **Supplementary Files:** Read Article
October 18th		**Before classroom:** **Virtual classroom:** **After classroom:** **Supplementary Files:**
October 25th	Bond Graph applied in Biology Systems.	**Before classroom:** Write brief **Virtual classroom:** Part 1 with Prof Fleury **After classroom:** Review other students brief **Supplementary Files:**
November 1st	Avaliação?	
November 5th	Close Class Overview	**Final Lecture**

BASIC BIBLIOGRAPHY

System Dynamics and Control with Bond Graph Modeling Edição Inglês | por Javier Kypuros, Publisher, CRC Press 2013, ISBN 9781466560765. (Text Book)

2017 – LEITE, C. R. M. (Org.) ; Suelia Rodrigues Fleury Rosa (Org.) . Novas tecnologias aplicadas à saúde: integração de áreas transformando a Sociedade. 1. ed. Mossoró, RN: EDUERN, 2017. v. 1. 284p

2018 – MACEDO, F. S. (Org.) ; ROSA, M. F. F. (Org.) ; Suelia Rodrigues Fleury Rosa (Org.) ; LEITE, C. R. M. (Org.) . Plenitude e Completude de Fazer Ciência. 1. ed. RIO GRANDE DO NORTE: Universidade do Estado do Rio Grande do Norte, 2018. v. 1. 344p

2019 – LEITE, C. R. M. (Org.) ; REIS, C. A. (Org.) ; BINSFELD, P. C. (Org.) ; ROSA, S. S. R.F. (Org.) . Novas tecnologias aplicadas à saúde: desenvolvimento de Sistemas Dinâmicos - Conceitos, aplicações e utilização de técnicas inteligentes e regulação. 1. ed. Mossoro - RN: EDUERN, 2019. v. 2. 608p. (Text Book)

ROSA, Suelia de Siqueira Rodrigues Fleury et al. Mathematical modelling of the human tibia using Bond Graph. Rev. Bras. Eng. Biomed. [online]. 2013, vol.29, n.4, pp.329-342. Available from: ISSN 1517-3151. https://doi.org/10.4322/rbeb.2013.042.

Bond Graph in Modeling, Simulation and Fault Identificatio (English Edition) Edição Inglês | por Ranjit Karmakar & Arun Kumar Samantaray Amalendu Mukherjee.

Diabetes Ground Control: A Novel System for Correcting Anomalous Stride in Diabetic Patients

By Suélia de Siqueira Rodrigues Fleury Rosa, Mário Fabrício Fleury Rosa, Marcella Lemos Brettas Carneiro, Leticia Coelho, Diego Colón and Célia Aparecida Reis DOI: 10.5772/intechopen.74040

Karnopp D, Rosenberg RC. System dynamics: a unified approach. New York: Wiley Interscience Publication; 1975. Karnopp D. Bond graph models for eletromagnetic actuators. Journal of The Franklin Institute. 1985; 319(1-2):173-81. http://dx.doi.org/10.1016/0016-0032(85)90072-9

Rodrigues SS, Simões TS, Kienitz KH, Trabasso LG. Modelagem e controle do suporte das lâminas da serra inteligente guiada por um sistema robótico para assistência em cirurgias de osteotomia. In: Congresso Temático de Dinâmica e Controle da SBMAC: Anais do 3. Congresso Temático de Dinâmica e Controle da SBMAC; 2004, Ilha Solteira. Ilha Solteira: UNESP; 2004. (CTA/ITA-IEE/ AE-055/2004).

SSRF Rosa, ÊKF Souza, PAA Urbizagástegui, LRT Peixoto, AF Rocha, Modelagem matemática da tíbia humana usando Bond Graph, Revista Brasileira de Engenharia Biomédica 29, 329-342

Miller KS, Ross B. An Introduction to the Fractional Calculusand Fractional Differential Equations. Willey-Interscience: John-Wiley & Sons, 1993.

Podlubny I. Fractional Differential Equations. Academic Press, v. 198, 1999.

Camargo RF, Chiacchio AO, Oliveira EC, Differentiantion to Fractional Tlegraph Equation. Journal of Mathematical Physics, v. 49, n.033505, 2008.

Gorenflo R, Mainardi F. Fractional Calculus: Integral and Differential Equations of Fractional Order. CISM Lecture Notes, p.223-276, 2000.

RESEARCH ARTICLE 1

Bond Graph modeling of the human esophagus and analysis considering the interference in the fullness of an individual by reducing mechanical esophageal flow – Suelia Rodrigues Fleury

RESEARCH ARTICLE 2

Biomechanics and mechanobiology in functional tissue engineering. J Biomech. 2014 June 27; 47(9): 1933–1940. doi:10.1016/j.jbiomech.2014.04.019.

RESEARCH ARTICLE 3

Bond Graph Modeling of Mechanical Circulatory Support Device— Cardiovascular System Interactions - [DOI: 10.1115/1.4045812]

RESEARCH ARTICLE 4

Modeling of the human tibia bone using Bond Graph - https://doi.org/10.4322/rbeb.2013.042