Focus Innovation Session: Mathematical modelling of adaptive cycle

13th – 15th of July 2026, Bled, Slovenia

Programme

Monday, July 13th

8.00 - 9.00 Breakfast
9.00 - 9.30 Discussion 1: *Why are we here?*
Goal: To discuss open problems related to the topic of the meeting in different fields, identify key knowledge gaps, highlight the importance of potential advances, and explore the most optimistic outcomes that could be achieved through the project.

9.30 - 10.30 Lecture 1: *Introduction to ecosystem dynamics*, Brian Fath
10.30 - 11.00 Discussion 2: *How to model life systems?*
Goal: Specification of the structural characteristics of ecological networks and their dynamics that should be included in the mathematical model.

11.00 - 11.30 Coffee break

11.30 - 12.30 Lecture 2: *Introduction to age structured population models*, Aleksandra Puchalska
12.30 - 13.00 Discussion 3: *How to model ecological dynamics via McK-vF system?*
Goal: Incorporation of the properties of ecosystem from Discussion 2 into McKendrick-von Förster framework with linear and non-linear trophic relations.

13.00 - 16.00 Lunch break

16.00 - 17.00 Lecture 3: *Further information about the adaptive cycle*, Hanna Zoller
17.00 - 18.30 Discussion 4: *How to model adaptive cycle with PDEs?*
Goal: Specification of adaptive cycle properties that the dynamical system should reproduce. Discussion on drivers of each phase of the adaptive cycle.

19.00: Dinner

Tuesday, July 14th

8.00 - 9.00 Breakfast
9.00 - 9.30 Discussion 5: *Transition from collapse to reorganisation phase.*
Goal: Brainstorming session on the existing results on the system collapse: motivation in life and man-made systems, mathematical techniques, existing numerical measures.

9.30 - 10.30 Lecture 4: *Introduction to spectral methods for unbounded operators*, Marjeta Kramar Fijavž
10.30 - 11.00 Discussion 6: *Evolution of spectrum in the adaptive cycle.*
Goal: Discussion on spectral measures that fit best to adaptive cycle, characterization of their monotonicity depending on the phase, methodology to deal with transition from collapse to reorganisation in linear model.

11.00 - 11.30 Coffee break

11.30 - 12.30 Lecture 5: *Introduction to differential game theory*, Dominika Machowska
12.30 - 13.00 Discussion 7: Formulation of adaptive cycle in the language of differential game theory.
Goal: Incorporation of the properties of the different phases of the adaptive cycle identified in Discussion 4, with particular emphasis on the transition from collapse to reorganization considered in Discussion 5, to formulate the optimization problem.

13.00 - 16.00 Lunch break

16.00 - 18.30: Work in subgroups.

19.00: Dinner

Wendesday, July 15th

8.00 - 9.00 Breakfast
9.00 - 10.00 Lecture 6: *Adaptive cycle vs higher order interactions*, Piotr Wojtala
10.00 - 11.00 Discussion 8: Conclusions
Goal: Summary of the key insights and results obtained throughout the meeting, identification of further research steps and challenges, a road-map for future development.

11.00 - 11.30 Coffee break and closure.