Overall MELiSSA loop control and possible strategy

Key words: Control strategy, stability, robustness, circular system,

Abstract: The MELiSSA loop has to maximize the recovery of the main elements of waste recycling in order to produce the mandatory human metabolic needs of the consumer compartment. Therefore it is meant to become as much as possible a circular system especially in close and remote environments as the planetary stations, the space vehicles or terrestrial closed ecosystems (e.g. deserts). Although many progresses have been realized in the modelling of the MELiSSA processes at the knowledge model and consecutively at the control level, these progresses were mainly carried out at independent unit (e.g. a compartment). (The objectives of the control of a circular system raises numerous challenges that need to be taken into account). The MELiSSA loop is composed of interacting processes and technologies: bioreactors, filters, catalysers, plant chamber and crew compartment and faces a real diversity of dynamics and of non-linear processes. The final objective of this work is to manage the flows and stocks of the MELiSSA closed loop to reach the best set of ALISSE criteria (e.g. mass, efficiency, energy, crew time, safety).

Starting from the existing state of the art within MELiSSA community, the proposed PhD project would first study and propose a dynamic model of the MELiSSA loop for further assessment of the control strategies.

This work shall be supported with MELiSSA simulation tools. This MIL (Model In the Loop) methodology will be used to test in virtual environment the control and assess the performance and robustness of the system.

Impact on MELiSSA: Definition of control strategies and operation.

MELiSSA partners: Sherpa (F), UClermont Auvergne (F), Enginsoft (I).

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Desired knowledge: Candidates preferably possess a degree in control engineering,
        system or mathematics. They have to be familiar with biology principles and
        process engineering.