Building a Work Plan

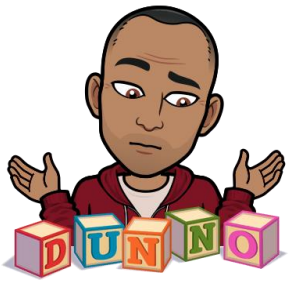
1

From SoA to Work Plan

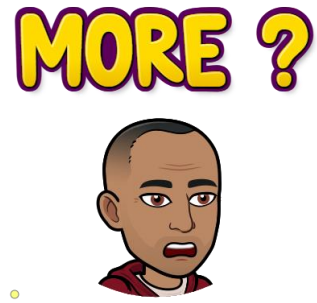
2

From SoA to Work Plan

- You have a crictical state-of-the-art, what is it useful for ?



Identify what can be used in your project



Identify what is lacking

3

From SoA to Work Plan : Example

Robust optimization of tuned-mass-dampers (TMD) installed on large-scale structures submitted to loading and structural uncertainties.

1. **State of the art**

Tuned mass dampers are passive devices consisting of mass-spring-damper system(s) attached to the main vibrating system (host-structure) to reduce the undesirable vibrations of the host-structure (Figs. 1-2).

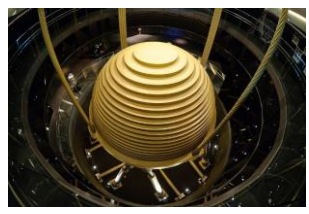


Figure 1. Tuned mass damper at top of Taipei 101 building (taken from https://www.atlasobscura.com/places/tuned-mass-damper-of-taipei-101)

Figure 2. The TMD used in the passenger foot-bridge (taken from http://www.roadjz.com/en/show.asp?id=18)

4

From SoA to Work Plan : Limitations

Various researchers [1-4] have optimized the TMD system for different combinations of idealized host-structural systems such as single-degree-of-freedom (SODF) and limited multi-degree-of-freedom (MDOF) systems subjected to white noise.

Limitations

Real-life host-structures are never SDOF systems, and their behavior should be represented by a set of modes. Reducing the behavior to a single mode may lead to oversimplification and poor design of the TMD.

Another important aspect in the real-life applications is the presence of the following uncertainties [5-9]:

1) Uncertainties related to the loading itself (nonstationary stochastic excitation)
2) Uncertainties related to the host structure (mechanical properties)
3) Uncertainties related to the installed TMD parameters (mass, stiffness, damping)

5

From SoA to Work Plan : Identifying limitations

Limitations

To the best of the knowledge of the author, the literature does not contain any study related to the optimization of a TMD system in case of a large-structural system subjected to nonstationary earthquake or wind excitations.

One of the major reasons behind not attempting so previously seems to be the excessive computational cost of this type of optimization.

The optimization of TMD parameters for large-scale structures would become even more computationally costly and complicated if the uncertainties on both the loading and structural parameters are accounted for.

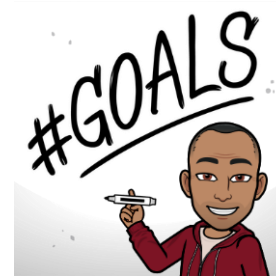
6

Defining the objectives

7

Objectives

- Define clearly your objectives/sub-objectives



Example :

Main objective :

The objective of the research is to develop a fast and efficient numerical tool to address the problem of robust optimization of tuned-mass-dampers (TMD) for large-scale structures submitted to loading and structural uncertainties and to validate it on a real-life example

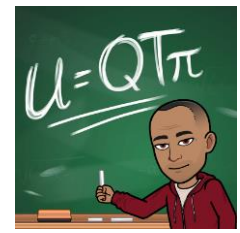
8

8

Sub-objectives

Sub-objectives :

- Address the problem of robust optimization for 1 simplified 1 DOF model
  - Structural uncertainties
  - Uncertainties on the loading
- Develop efficient model reduction strategies to deal with real-life problems
  - One mode approach
  - Multi-mode approach
- Validate the approach on a real-life application
  - Design of the optimal TMD
  - Fabrication and implementation + testing



9

9

Building the Work Plan

10

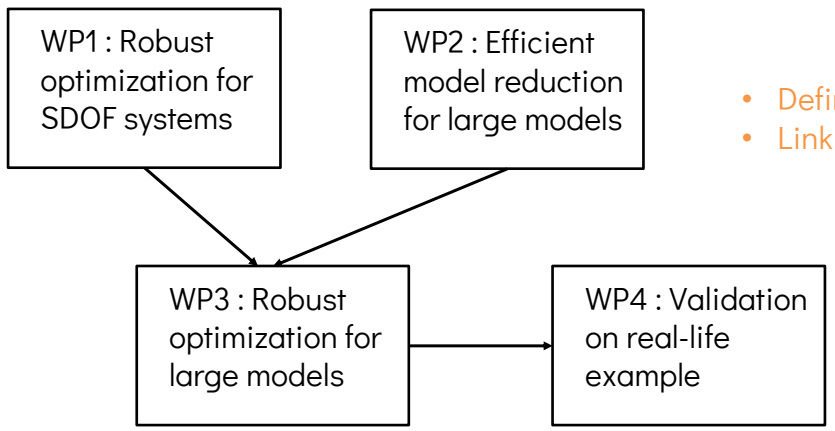
Methodology

- Develop a methodology to reach your objectives
  - Divide your work into tasks/work packages
  - Link the tasks together (Pert chart)
  - Make a provisional timeline (Gantt Chart)

11

11

Making a Pert chart



- Define WPs wrt objectives
- Link WPs with arrows

12

12

Defining tasks

WP1 : Robust optimization for SDOF systems

- Task 1 : Robust optimization of a TMD attached to a SDOF system containing structural uncertainties
- Task 2 : Robust optimization of a TMD attached to a SDOF system with uncertain loading
- Task 3: Robust optimization of a TMD attached to a SDOF system with uncertain both on the host structure and the TMD
- Task 4: Combined optimization under structural and mechanical uncertainties

WP2 : Efficient model reduction for large models

…..

13

13

Describing tasks

Task 1 : Robust optimization of a SDOF system containing structural uncertainties

Different approaches exist in the literature to deal with optimal tuning ot TMDs when the host structure contains uncertainties. The uncertainties can be modeled either using a parametric [1] or a non parametric approach such as intervals [2].

An interesting approach presented in [3] extends the concept of equal peak method to host structures for which the uncertainty is modeled with intervals, and the efficiency of the method will be assessed in this study.

Other methods exist based on a parametric description of the uncertainties where the quantity to be optimized is based on quantiles of the output quantities [4]

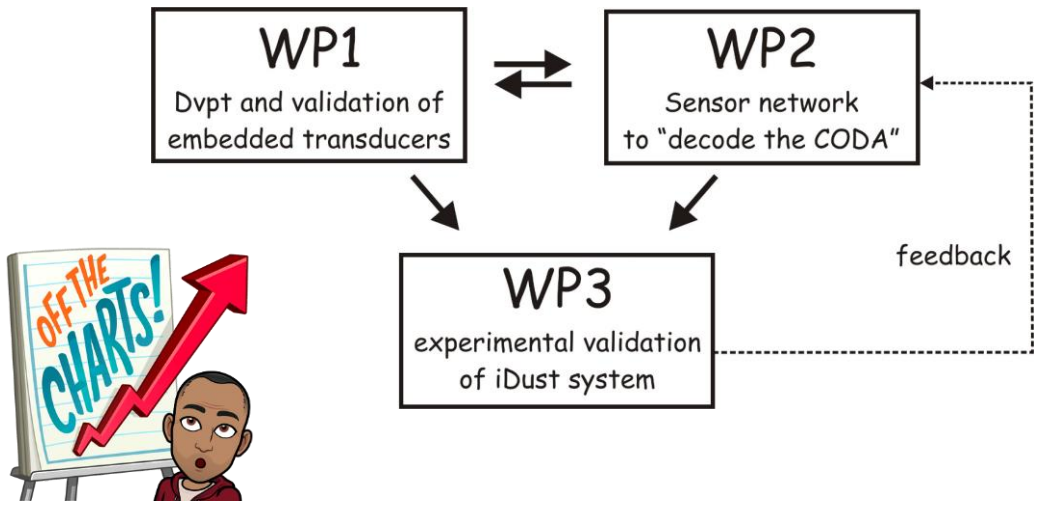
….

The different approaches will be studied and compared in order to identify the best approach to be used in WP 3.

14

14

Other example of a Pert chart



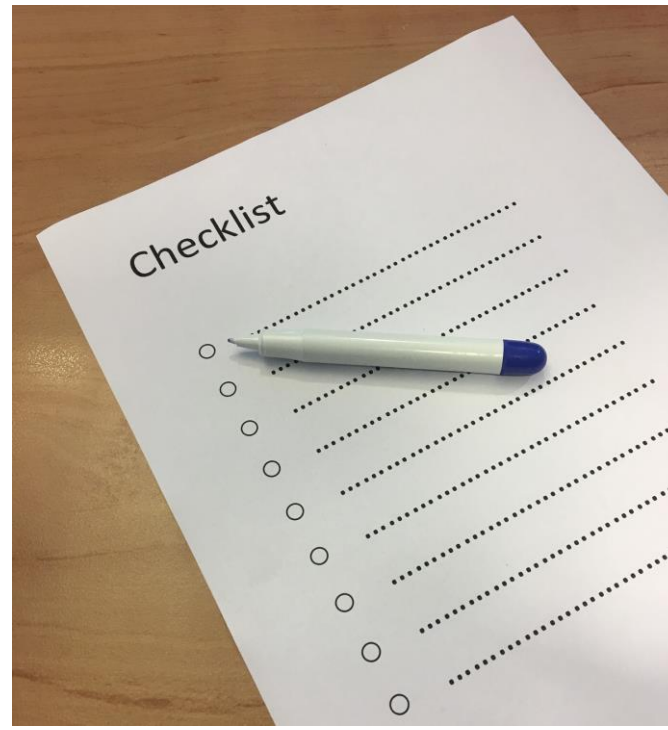
15

Making a timeline : the Gantt chart

	2021				2022					
	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May	June
WP1 : Robust optimization for SDOF systems										
T1.1 SDOF with uncertainties										
T1.2 Loading uncertainties										
T1.3 TMD uncertainties										
T1.4 Combined uncertainties										
WP2 : Efficient model reduction for large models										
WP3 : Robust optimization for large models										
WP4 : Validation on real-life example										

16

Summary for the report



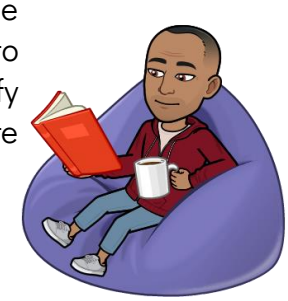
17

Summary for report

- **A short abstract** (½ page)

- **An introduction** giving the background, context and motivation and general objective of the work (1-2 pages)

- **A critical and structured state-of-the-art** containing the most important references, a description of the relevant information from these publications and their link with the topic of the research, as well as their adequacy or limitations with respect to the problem treated. The state-of-the art should clearly identify the gaps in the existing methods/applications which motivate the research and define the goals. (2-3 pages)



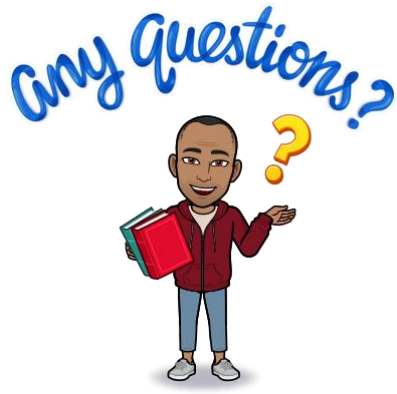
18

Summary for report

- **A clear and structured work plan**. The work plan should be clearly linked to the gaps identified in the state-of-the-art and be aimed at filling these gaps, by proposing specific methods. In doing so, the work should be structured in tasks, which are themselves gathered in work packages. A Pert chart showing the links between work packages and tasks (which output result is used as an input to which task?) should be included (2-3 pages)

- **A tentative schedule**. At this stage it is important to imagine how the tasks defined in the work plan should be arranged in time in order to finalize the research work by the end of the academic year. As always in research, this is only tentative and will be used as an adaptable roadmap during the thesis. (1 page)

19



20

20