

Temaområde: Pålitelighet av konstruksjoner

Safety is a principal requirement for structures. The safety of structures is normally proven by the application of the safety concept in the prevailing structural design standard. Here, uncertainties related to the estimation of loads, load effects and resistances are accounted for indirectly by calibrated safety factors in order to provide sufficiently reliable solutions for regular design situations.

However, many practical situations are not regular in that sense. Many engineering structures are rather particular in regard to e.g. the load environment, the structural response to load effects, the deterioration of structural materials, the consequences of failure etc. Structural codes are only of limited use for these extraordinary structures and uncertainties have to be considered explicitly in order to base decisions related to these structures on reliability or risk criteria.

The “Structural Reliability Group” currently consists of 1 Professor, 1 Post-Doc and 2 PhD Students. The research field covered over time is rather wide when measured in traditional engineering disciplines, i.e. structural load bearing behaviour of concrete, steel or timber structures, load modelling, assessment of existing structures, offshore structures and even space structures. The common denominator on projects ranging that wide are the challenges of uncertainty representation, reliability estimation and decision-making subject to risks.

Master students are welcome to perform their master thesis in our group! Projects can be written either in Norwegian or English. Master projects generally evolve from practical engineering problems or ongoing research projects. The master projects at our group might be rather demanding, but at the same time facilitate for a steep learning curve that is not least provided by close and collegial tutoring throughout the projects.

If interested in writing a Master thesis on a highly relevant and challenging topic, please contact: jochen.kohler@ntnu.no

In the following, **possible topics** for writing a project and master thesis are given as examples. Further topics are possible after consulting.

1) Assessment of existing bridges



Transport infrastructure owners have to manage and maintain large portfolios of bridges. In particular, they have to ensure that these bridges are safe and do not set its users at risk or impair with the transportation performance of the traffic network. Bridges have a rather long service life and during that period doubts about the structural integrity of the bridge might arise e.g. due to increased traffic

loads or obvious or supposed deterioration process in the structural material. These doubts require the reassessment of the structural reliability of the bridge.

In this Master Project we will exercise the assessment of an existing concrete bridge in the northern part of Norway. Measurement data on the bridge will be incorporated in the analysis and important insight about the reliability and the residual safe service life will be gained. The work is closely followed by and in collaboration with Statens Vegvesen and the corresponding Fylkeskommune and has high practical relevance. The Master Project is also very much related to an ongoing PhD project. Groupwork is possible.

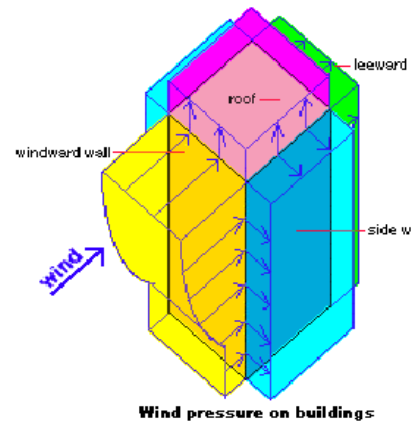
2) Towards Modern and Sustainable Design of Structures



The built environment is of obvious importance for our sustainable development as it not only facilitates societal activity but also has a major share on the worldwide turnover of economic and environmental resources. To date the built environment is developed and maintained by broadly following structural design standards, which did evolve continuously over time and contain safety concepts that support daily structural engineering decision making based on simple calculus. The major objective that has been followed in their development, was the provision of sufficient safety, and the observed relative low failure rates do proof success in this regard. However, as conceived, structural design codes do not allow for the optimal allocation of the limited financial and environmental resources into the structural performance. In this context, a major research focus in our group is the development of methodologies to calibrate the safety concept of existing design standards, such that their broad implementation will lead to a significant increase of resource efficiency with simultaneous conservation of the present average safety level. A possible Master Project can assist the ongoing efforts in this regard. This is currently a hot topic in the international engineering community and collaboration and interaction with international partners is ongoing and will also enrich the possible Master Project. Groupwork is welcome.

3) Wind load on structures – calibration of the Eurocode safety concept

The current version of the Eurocodes contains a rather complex concept for the consideration of wind actions on structures. The concept includes a large number of assumptions and simplifications that link the general exposure to wind speed to actual forces acting on the structure dependent on its exposure and geometry. To date it is still not well understood what uncertainty and bias is induced by these assumptions and simplifications, however, an understanding of this would be necessary to make any sensible statement about the validity of the currently applied safety factors for wind loads. The main objectives of this master project are to review and document the current Eurocode design concept for wind loads with special account for the uncertainties and bias induced by the several assumptions and simplifications that are included. Basis will be taken in existing literature but also in current results from wind tunnel tests on buildings. The work will converge to a well-documented model basis that can be used e.g. for the calibration of the current Eurocode safety concept for the consideration of wind actions.



The interaction of wind and structures is complex, although it is represented quite simple in structural design.

Examples for past Masterprojects

- Growth of fatigue cracks in mooring line chains
- Numerical investigation of 3D scanned mooring chains
- A Bayesian Approach for Risk-Based Replacement of Mooring Lines
- Reliability assessment of concrete structures using non-linear finite element analysis
- Assessment of a semi-probabilistic safety concept for reinforced concrete columns using non-linear finite element analyses
- Generic Framework for Stochastic Modeling of Reinforced Concrete Deterioration Caused by Corrosion
- Reassessment of the integrity of a partially failed glulam structure
- Probabilistic Methods in Management and Inspection of Buried Steel Pipe Bridges

Info-meeting will take place Thursday 27.4.2023, kl. 14.15 in meeting room "Gjørv", see directions [here](#).

The meeting will also streamed via Microsoft Teams meeting :

Join on your computer, mobile app or room device

[Click here to join the meeting](#)

Meeting ID: 365 406 712 621

Passcode: 6pjNfi