

Collision Project Work Plan

Hypothesis: The Minorsky method with:

- 3 DOF ship external dynamics;
- a simple model for striking ship bow stiffness;
- a simple model to locate the low energy Minorsky intercept; and
- Minorsky line slope calibration as a function of struck ship type and critical design parameters;

provides a sufficient collision model best adapted for probabilistic and concept design analyses. In the absence of sufficient actual data, more elaborate methods such as FEA can be used to define the Minorsky slope as a function of selected structural design parameters.

1. VT Grad Students

- (Dongui) Update and use baseline collision model (modified Minorsky, 3 DOF/ship, rigid bow). Plot and assess a range of scenario inputs. Assess consistency and sensitivity. Improve damage geometry definition, calculation of shell resistance prior to rupture and calculation of forces.
- (Surya) Add striking ship bow definition to scenario variables. Include relative drafts, bow height, simplified geometry and simplified stiffness definition. Develop subroutine to include in collision model.
- (Dongui) Incorporate non-rigid bow model into collision model. Plot and assess a range of bow definition inputs. Assess consistency and sensitivity.
- (Surya) Continue development of course-mesh nonlinear finite element collision model. Interface with external dynamics.
- (TBD) Using data from Ad Hoc Panel, make a series of validating/comparison runs using VT models (modified Minorsky with various submodels and FEA), simple Minorsky, and other models from contributing researchers. Assess.
- (TBD) Apply best model(s) to analysis of IMO reference tankers and for various collision scenarios and energies. Use best simplified method to define Minorsky low energy intercept and other results to regress a set of Minorsky curves which would be a function of selected DH tanker design parameters.

2. VT Undergrads

- (Josh) Develop HECSALV and SAFEHULL models for 150000 dwt and 60000 dwt IMO Reference Double Hull designs. Work with Dongui to define a variety of structural designs for each which span a range of structural design variables.
- (Chimi) Develop HECSALV and SAFEHULL models for 5000 dwt and 283000 dwt IMO Reference Double Hull designs. Work with Dongui to define a variety of structural designs for each which span a range of structural design variables.

3. SNAME Ad Hoc Panel / All

- (WG2) Identify and obtain data for validating collision cases. Cases with prior FEA or other analyses would be useful.
- (Brown / WG1) Solicit support of others with collision models to make similar validating runs or provide models for VT students to run.
- (WG2 / WG3) Improve other scenario pdfs using collected data.
- (WG1 / WG3) Apply modified-Minorsky model with improved scenario pdfs to calculate damage extent pdfs for IMO Reference Tanker variants. Compare and assess.