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To whom it may concern

Current at a quasi-steady ship 'model' powering trial

References

- Reference:C:\model_test\mod_prel.mcd
- Reference:C:\model_test\mod_rout.mcd
- Reference:C:\model_test\mod_data.mcd

Input of filtered and stationary data

dat_filt := READPRN("Dat_filt")

\[
\begin{bmatrix}
\Delta t & N & S.filt & P & S.filt & V & HG.filt & a_{rel} & T & S.filt
\end{bmatrix} := \text{dat_filt}
\]

dat_stat := READPRN("Dat_stat")

\[
\begin{bmatrix}
\text{ind} & \Delta t & \text{stat} & V & HG.stat
\end{bmatrix} := \text{dat_stat}
\]

\[k := 0, \text{last}(\Delta t_{\text{stat}})\]

\[N S.stat_k := N S.filt(\text{ind}_k)\]

\[P S.stat_k := P S.filt(\text{ind}_k)\]

\[\Psi HG.stat_k := \pi\]

Hull speeds over ground vs time

Hull speeds over ground in m/s

1.32
1.34
1.36
1.38

-100
-50
0
50
100

\(\Delta t, \Delta t_{\text{stat}}\)

time in s
Identify 'tidal' period in the tank

The criterion adopted

In view of the small current amplitude to be expected
the minimum of the mean current has been adopted
as criterion for the selection of the current period.

A check has shown, that the mean current identified
equals the mean current identified with the harmonic
component assumed to be non-existent.

Survey of mean current as function of the tidal period

\[ C_m(n, T_{ini}, \Delta T) := \begin{cases} S_{j,0} \leftarrow T_{ini} + j \cdot \Delta T \\ \omega \leftarrow \frac{2 \cdot \pi}{S_{j,0}} \\ V_{WG.m} \leftarrow C0(\omega, \rho, D, \Delta t_{stat}, V_{HG.stat}, \psi_{HG.stat}, N_{S.stat}, P_{S.stat}) \\ S_{j,1} \leftarrow V_{WG.m} \end{cases} \]

\[ n := 8000 \quad T_{ini} := 60 \quad \Delta T := 0.01 \]

\[ S := C_m(n, T_{ini}, \Delta T) \]
Find minimum

\[ SS := csort(S, 1) \]
\[ s := \langle SS^T \rangle^{<0>} \quad s = \begin{bmatrix} 90.96000 \\ 0.08439 \end{bmatrix} \]
\[ \omega := \frac{2 \cdot \pi}{s_0} \quad \omega = 0.06908 \]

All results identified at the quasi-stationary conditions

\[
\begin{bmatrix}
\Delta P_{S, sup} \\
V_{WG, stat} \\
V_{HW} \\
\rho \\
\Delta t_{stat} \\
P_{S, sup} \\
J_{HW} \\
P_n \\
K_{P, sup}
\end{bmatrix}
:= \text{Supplied}(\omega, \rho, D, \Delta t_{stat}, V_{HG, stat}, \psi_{HG, stat}, N_{S, stat}, P_{S, stat})
\]

Residua scrutinised

![Noise in shaft power vs time]

Check of distribution

\[
\begin{bmatrix}
\text{distr} \\
\text{sampl} \\
\text{sort} \\
\text{sampl_fair} \\
\text{distr} \\
\text{par}
\end{bmatrix}
:= \text{norm_distr}(\Delta P_{S, sup})
\]
**Current identified**

\[ i := 0 \ldots \text{last}(\Delta t) \]

\[ V_{\text{C.mean}} := v_0 \quad V_{\text{C.mean}} = 0.08439 \quad \text{mean current} \]

\[ T_{\text{C}} := s_0 \quad T_{\text{C}} = 90.96000 \quad \text{tidal period} \]

\[ V_{\text{C.ampl}} := \sqrt{\left(\langle v_1 \rangle^2 + \langle v_2 \rangle^2\right)} \quad V_{\text{C.ampl}} = 0.00700 \quad \text{tidal current amplitude} \]

**'Tidal' current at quasi-steady states**

\[ V_{\text{WG.filt}} := V_T(\omega, v, \Delta t_i) \]

**Store current values at quasi-steady conditions**

\[ \text{dat_curr} := V_{\text{WG.filt}} \]

\[ \text{WRITEPRN}("Dat_curr") := \text{dat_curr} \]
Propeller powering characteristic identified

![Power ratio vs hull advance ratio graph]

Store parameters of powering characteristics

dat_pow := [p  p_n]

WRITEPRN("Dat_pow") := dat_pow

Conclusions

Identifying the current in the model basin and the propeller powering characteristic in the behind condition, based on the quasi-stationary conditions passed during the quasi-steady trial, is a method already applied in 1989 and mentioned in the Proceedings of my 2nd INTERACTION Berlin '91, thus paving the road for full scale applications.

The investigation of the current in the tank, 'usually' performed only in cases of doubt, of 'tank storms', poses special problems not to be expected on full scale.

The tidal current model adopted maybe considered as inadequate, even 'wrong' on model scale, in 'towing' tanks. But 'according' to the motto, it turned out to be 'particularly' useful.

The mean current identified in the present case is 'considerable', but not unlikely, as the test analysed has been the eighth in a series of quasi-steady tests.
On full scale also the powers required due to the motion through the water and due to wind and waves can be identified separately and thus, with the propulsive efficiency identified before, even the hull resistance and the wind and wave resistance! *Nota bene:* No thrust measurements being required!

For the standard ISO 19030 under development the rational procedures successfully developed on model scale will be fundamental.

Altogether this completes the triumph of Fritz Horn's vision and proposals tested before and discussed during the 4th ITTC at VWS Berlin 1937. At that time it 'only' suffered from inadequate conceptual, experimental and computational tools and further developments were disrupted by the second world war.

**END**

*Current etc at a quasi-steady ship 'model' powering trial*