ENIRAM STUDIES

DYNAMIC VS. STATIC TRIMMING

HOW REAL-TIME DYNAMIC TRIMMING SAVES MORE FUEL THAN STATIC TRIMMING

Exploring the key differences between static and dynamic vessel trimming and how dynamic trimming offers the more cost-effective path to finding the real-time optimal trim for each and every voyage.

The trim of a vessel impacts the total force required to propel a vessel through water, so for different loading conditions and speeds there is an optimum trim value. If the vessel is not sailing at or near the optimum trim then it is experiencing more resistance and in particular more wave making energy which again requires more power and fuel.

In today’s world of high fuel prices, it is recognized that trimming a vessel effectively can contribute to better fuel efficiency. To date many ship owners/operators are still using static trim tables as the predominant method of obtaining values for optimal trim. These static trim tables are prepared for the vessel in simulated conditions and are usually calculated based on 2 or 3 variables for example draft, speed etc. They are not able to reflect the dynamic external factors that affect a vessel at sea, such as weather, currents, wave-making, etc.

A more accurate way of calculating trim is to monitor vessel performance data in real-time while taking account of the effect of dynamic conditions such as wind, and sea state. This delivers a greater accuracy and insight into how the vessel is performing and how this affects propulsion power and related fuel consumption. Knowing the optimum dynamic trim, means knowing what angle to the waterline the vessel should operate at in order to consume the least amount of fuel. Using less fuel means lower bunker bills and CO2 emissions.

Static trim (measured when a vessel is not moving) and dynamic trim (measured when a vessel is out at sea) invariably produce different results due to a complex set of factors including vessel design, loading conditions, speed, weather, and water depth. While using static trim tables can help vessel trimming at sea, dynamic trimming is the certain way to pinpoint optimum efficiencies, while building up a data repository for longer term efficiency benefits.

STATIC TRIM

Traditionally, optimal trim has been explored using tank testing – the results of which are compiled into a static trim chart or table, which displays values for the optimum trim for a reasonable number of speeds and drafts and pre-defined parameters. However, this method, does not take into account the effects of the real-time variable conditions at sea. Generally, the static trim model focuses on the bow to allocate the best angle to operate the vessel, and does not take account of the height of the stern which would be a better indicator of propulsion efficiency.
The accuracy of static trim measurements is improved by sea/speed trials run by shipyards, but these only cover the relatively small variation in environmental conditions the vessels are exposed to during testing.

In summary, static trimming works with a given set of pre-calculated figures based on a number of variables. When dealing with prevailing conditions that operate outside these parameters, optimum trimming cannot be supported.

**DYNAMIC TRIM**

With developments in data collection technology and analysis, today it is possible to determine the actual trim of a vessel at sea at any given time, which can deliver significant efficiencies in fuel consumption. In 2007, Eniram pioneered the most accurate way to measure dynamic trim by installing high-precision attitude sensors (inclinometers) on board the vessel. Data collected from the sensors is combined with information gathered from the vessel’s own systems relating to its performance in prevailing conditions.

This process takes account of the changing variables to calculate the effect of trim on performance - including hydrodynamic forces, such as squat, propeller thrust and manoeuvring rudder angles. It also factors in the impact of additional weather conditions such as wind, sea state, rolling and surging as shown in Figure 1.

![Figure 1 - The factors influencing a vessel's trim](image)

A value for the optimal trim is then calculated and displayed to the crew in real time on the bridge. It takes the form of an easy to interpret traffic-light system for maximum clarity showing the actual dynamic trim at any given time and the extent to which this is optimized. Indeed Eniram technology facilitates planning and integration of trimming as part of the normal operating procedures onboard a vessel.

Continuous data collection, filtering and analysis are used to constantly improve the accuracy of the optimum trim. By collecting large amounts of data from various factors affecting the energy usage of the vessels, it is also possible to monitor the power decomposition of a vessel. This can help an opera-
tor’s staff, onboard and onshore, to further pinpoint potential areas for improvement in other areas and to make fleet-wide performance comparisons.

In summary, dynamic trimming provides highly accurate trimming advice based on the collection and analysis of exact real-time data on a vessel’s trim performance. Operating at optimal trim using less power and fuel can also contribute to condition-based maintenance improvements and prolonged machine life.

A SIMPLE, VIABLE WAY TO CUT COSTS USING DYNAMIC TRIM

Knowing the facts behind performance is the key to managing fuel efficiency and reducing costs. For example, a large cruise or container vessel can easily save 1,000 tonnes of fuel per year which is about $650,000 in today’s fuel prices, and with this initiative, 3500 tonnes less of CO2 emissions don’t end up polluting the atmosphere. In today’s eco-focused and highly-regulated shipping world, this substantial operational benefit is one that ship owners and operators should not ignore and of course it makes good business sense.

In fact, on average, Eniram’s customers, depending on the vessel type, journey and length, achieve payback in less than a year.

ABOUT ENIRAM

Established in 2005, Eniram provides the maritime industry with decision support and data analytics technology that reduce fuel consumption and emissions. The product portfolio, created by experienced seafarers and technologists, ranges from single onboard applications to comprehensive fleet analysis and is used by both small and large shipping companies on vessels ranging from cruise liners, tankers, container ships, bulkers, LNGs and ferries. These companies rely on Eniram’s technology to enhance their vessel efficiency and operation and benefit from significant environmental savings and enhanced information intelligence.

ENIRAM PROVIDES SHIP OPERATORS WITH

- Onboard applications delivering real-time guidance to maintain optimum vessel performance for maximum fuel efficiency
- Fleet performance management tool to monitor and compare the actual performance of each equipped vessel across an entire fleet
- Analytics services exploring the breadth, depth and velocity of the data collected to further improve efficiencies and validate the results of other energy saving initiatives such as propeller changes, hull modifications and antifouling measures.

Visit our website www.eniram.fi or contact us for more information.

Captain Melvin Mathews
Director of Regulatory and Environment Solutions
Eniram Ltd.
melvin.mathews@eniram.fi