TELE-MONITORIZATION OF A SHIP CONDITION BASED ON SIGNALS SUPPLIED THROUGH AN AUTOMATIC INTEGRATED SYSTEM

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The research will focus on the development of advance monitoring technologies oriented to assess/evaluate the ship condition by means of IAS data and ship/shore and shore/ship communications. This monitoring will be applied to re-engineering, operation and proactive maintenance of the ship. The tele-monitorization is divided into four main blocks: TLX, TLY, TLZ and TLG.

TLX: Telemetric System for ship-shore communication
TLY: Communications server for recording and storing data in a Data Base
TLZ: Data analysis for monitoring and predictive maintenance applications
TLG: Data transmission from the analysis unit to final system users (shipyards, ship-owners, equipment manufacturers, crews, etc.)

System Units and Functions

TLX: Is divided into two subsequent blocks, TLXAD and TLXCOM.

TLXAD: Gathers digital and analogical data values from different sources on board. Data capture is achieved by connecting to the local net the IAS (Integrated Automatic System). Compiled data is processed, normalized, prepared in packs, and delivered to TLXCOM, for later transmission.

TLXCOM: Actives the communication system if it is not in the permanent active modality and transmits to TLY the data packages received from TLXAD. The connecting and transmitting frequencies to send the data packages ashore are independent of those frequencies used by the TLXAD to communicate with the ship’s IAS, in sampling and data capture operations. The communication with the server TLXSRV is trustworthy with acknowledgment of the data transferred. TLXCOM deals with re-tries in case of errors or impossibility of communication. TLXCOM receives, as asynchronous signals from shore TLXSRV, reports and instructions. By these instructions TLX can increase or diminish the amount of data to be compiled from the IAS or its resolution, and also tune to the connection frequency or alternative routes for the transmission of data.

TLY: A shore based TLXY server (Ingeoman Office), which receives data from the different TLXCOMS records and stores the information in a data base. Initially, this data-base is used for verifying the system and establishing a prototype first level of vigilance for the ship subsystems TLZ: Establishes de algorithms, correlations and logics to watch the functioning state of the ship different subsystems. These algorithms are based on the concepts of statistical distances and orthogonal decompositions. The last level of TLZ consists in an expert system which detects anomalies, predicts breakdowns and makes a diagnosis of the originating causes. That is to say, a tool of Proactive and Predictive Maintenance.

TLG: The procedures to transmit the requested analysis data to final users have been already developed.

Ship-Shore Communications
Ship-shore communications are Internet communications of the IP type.

Connection and Internet access from the ship is achieved by satellite communications in order to get the global coverage required to keep in contact the ship with the TLXSRV any time, anywhere.

A TIME DEPENDENT F-K FILTER

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1 Introduction
The particular characteristics of seismic wave propagations call for the development of special approaches in signal processing. Seismic data are recorded from a set of seismometers. They are usually represented on a so-called record section which takes advantage of the lateral coherence between neighbour traces. The x-axis represents the distance between the seismometers while the y-axis represents the time. One of the most usual techniques to identify and separate coherent waves is the f-k filter, [3]. It consists of a 2D Fourier Transform (FT) followed by some selection filter. The 2D FT allows to pass from the time-distance domain to the frequency-wavenumber one. It is particularly adapted for signals which propagate at constant velocity. However, the characteristics of seismic signals often vary with time and make impossible an efficient use of the f-k filter. On the other hand, if two signals arrive at a different time but at the same frequency and velocity, they won’t be distinguished by this method. Thinking of the time-varying specificity of geophysic signals, we propose to adapt the f-k filter using a time-frequency spectral localisation method, called the S-transform.

2 The S-transform
The S-transform (ST) bridges the gap between the short time FT (STFT) and the wavelet transform. Like the STFT, the ST uses a window to localise the complex Fourier sinusoid but, unlike the STFT, the width and height of the window scale with frequency in analogy with wavelets. The ST of a time series is defined as [2]:

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