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ON THE COMPUTER CHARACTERIZATION OF SEABEDS BY SONARS

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The seabeds can be characterized by returned signals of a side-scan sonar because the backscattering is much more sensitive to the type and roughness of surface than the normal forward scattering. The side-scan sonar can be connected to a computer system which includes an analogue-to-digital converter and a package for digital signal processing to determine the seabed-type falling in one category as, e.g. clay, sand, gravel, etc. The rate of digitization is determined by the Nyquist criterion, and a purpose-made FFT chip is used to speed up the evaluation of Fourier transform. The older method of seabed classification is by use of pattern recognition methods to classify the side-scan sonar images of seabed areas. The newer method of seabed characterization is by use of statistics and spectral analysis of side-scan sonar signals for obtaining discriminatory numerical quantities [1–3]. The research was carried out at the School of Physics, University of Bath, and was sponsored by the British Telecom (initially the Post Office) in the period 1981–1985; it resulted in eight reports [4–11]. A paper [12] published in 1988 contains the supporting material and a reference to paper [3], but no mention of any of the reports [4–11] detailing the research carried out in the specified period. The developments in later years which came nearest to the research commented upon were published in 1993 and 1994 [13, 14], but with no mention of either papers or reports commented upon [1–12]. It can be mentioned as a curiosity that the word "characterization" was used in that context for the first time in 1984, i.e., 10 years previously. The main results of the research carried out in the period 1981–1985 are as follows.

The probability density function (PDF) and the cepstrum (the spectrum of the logarithm of spectrum) were found to be most useful for the purpose of the seabed characterization [5, 8, 9, 11]. The power spectrum alone [10] was later found to be more effective than originally thought. The correlation function was found useful for the detection of extended seabed features which reappear in a number of successive pings [6], and hence for the detection of geological features on the seabed. The textural features for pattern recognition used to classify the seabed areas according to their appearance were found to be less useful than the discriminatory numerical quantities of our method [7]. It was also found that a method for correcting the power spectra was required to make the results obtained with different side-scan sonar systems mutually compatible [10, 11]. It can be finally noted that the PDF of digitized signals was often closer to the Rayleigh than the Gaussian distribution which could possibly be explained by random phases of Fourier components [15].

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