AD-A195 540 NONLINEAR MECHANISMS FOR THE GENERATION OF NEARSHORE WAVE PHENOMENA(U) MASSACHUSETTS INST OF TECH CAMBRIDGE DEPT OF MECHANICAL ENGIN.. T R AKYLAS APR 88 1/1

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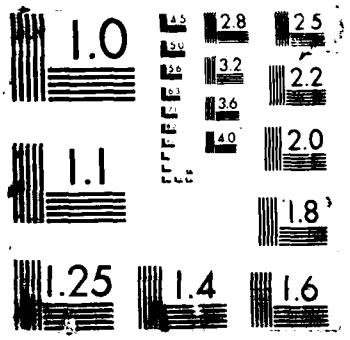
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4. PERFORMING ORGANIZATION REPORT NUMBER(S)	5. MONITORING ORGANIZATION REPORT NUMBER(S) ARO 21692.2-MA
6a. NAME OF PERFORMING ORGANIZATION MIT — 6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION U. S. Army Research Office
6c. ADDRESS (City, State, and ZIP Code) Dept. of Mechanical Engineering Cambridge, MA 02139	7b. ADDRESS (City, State, and ZIP Code) P. O. Box 12211 Research Triangle Park, NC 27709-2211
8a. NAME OF FUNDING/SPONSORING ORGANIZATION U. S. Army Research Office — 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER DAAG29-85-K-0171
8c. ADDRESS (City, State, and ZIP Code) P. O. Box 12211 Research Triangle Park, NC 27709-2211	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. — PROJECT NO. — TASK NO. — WORK UNIT ACCESSION NO.

11. TITLE (Include Security Classification)
Nonlinear Mechanisms for the Generation of Nearshore Wave Phenomena

12. PERSONAL AUTHOR(S)
T. R. Akylas

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Final	FROM 7/1/85 TO 2/29/88	April 1988	3

16. SUPPLEMENTARY NOTATION
The view, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation.

17. COSATI CODES		
FIELD	GROUP	SUB-GROUP

18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
Nearshore Wave Phenomena, Shallow Beaches, Water Waves, Beach Slope

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

Theoretical study of various generation mechanisms of nonlinear edge-wave phenomena on beaches through asymptotic and numerical techniques. In particular, the nonlinear longshore modulational instability of edge-wave packets has been investigated. Also, the forced response of water waves near cut-off conditions in a shallow channel was studied. Finally, numerical techniques for computing fully nonlinear periodic edge-wave phenomena on shallow beaches have been developed.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION
☐ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	Unclassified
22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE (Include Area Code) — 22c. OFFICE SYMBOL

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The studies have shown that (i) large-scale longshore variations of standing subharmonic edge waves are unstable and eventually give rise to recurrence phenomena. (ii) asymptotic analysis of the forced response of water waves near cut-off conditions leads to a forced Kadomtsev-Petviashvili equation. Numerical solutions of this equation indicate that steady state is reached only if dispersion is negative; otherwise, periodic generation of localized wave groups is found. (iii) there is numerical evidence that there is a critical steepness above which nonlinear periodic edge waves cease to exist; this threshold value of the steepness depends on the beach slope.

21692.2-MA

FINAL REPORT

1. ARO PROPOSAL NUMBER: 21692-MA

2. PERIOD COVERED BY REPORT: 1 July 1985 - 29 February 1988

3. TITLE OF PROPOSAL:
Nonlinear Mechanisms for the Generation of Nearshore Wave Phenomena

4. CONTRACT NUMBER: DAAG29-85-K-0171

5. NAME OF INSTITUTION: Massachusetts Institute of Technology

6. AUTHOR OF REPORT:

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Final Report

PROBLEM DESCRIPTION

Theoretical study of various generation mechanisms of nonlinear edge-wave phenomena on beaches through asymptotic and numerical techniques. In particular, the nonlinear longshore modulational instability of edge-wave packets has been investigated. Also, the forced response of water waves near cut-off conditions in a shallow channel was studied. Finally, numerical techniques for computing fully nonlinear periodic edge-wave phenomena on shallow beaches have been developed.

SUMMARY OF RESULTS

We have shown that: (i) large-scale longshore variations of standing subharmonic edge waves are unstable and eventually give rise to recurrence phenomena. (ii) asymptotic analysis of the forced response of water waves near cut-off conditions leads to a forced Kadomtsev-Petviashvili equation. Numerical solutions of this equation indicate that steady state is reached only if dispersion is negative; otherwise, periodic generation of localized wave groups is found. (iii) there is numerical evidence that there is a critical steepness above which nonlinear periodic edge waves cease to exist; this threshold value of the steepness depends on the beach slope.

LIST OF PUBLICATIONS AND PRESENTATIONS

1. T.R. Akylas & S. Knopping, "The Evolution of Subharmonic Edge Wavepackets on a Sloping Beach", *Wave Motion* **8**, 399–405 (1986) [also presented at the Fourth Army Conference on Applied Mathematics & Computing, Cornell University, May 1986].
2. Y.D. Kantzios & T.R. Akylas, "Long Nonlinear Water Waves in a Channel Near Cut-off Conditions", *Studies in Applied Mathematics* **78**, 57–72 (1988).
3. T.R. Akylas & Y.D. Kantzios, "Nonlinear Forced Water Waves in a Shallow Channel Near a Cut-off Frequency" in: *Nonlinear Water Waves* (eds. K. Horikawa & H. Maruo), pp. 63–67 (1987).
4. T.R. Akylas & J. Mathew, "Nonlinear Edge Waves on a Shallow Beach", presented at the 40th Meeting of the American Physical Society (Fluid Dynamics Division), Eugene, Oregon, November 1987.
5. T.R. Akylas, "Nonlinear Forced Waves" in: *Nonlinear Wave Interactions in Fluids* (eds. R.W. Miksad, T.R. Akylas & T. Herbert), pp. 157–163 (1987).

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