COMPUTER SOFTWARE

FOR

EARTHQUAKE ENGINEERING

JANUARY 1995

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NISEE

COMPUTER SOFTWARE
FOR
EARTHQUAKE ENGINEERING

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NISEE/COMPUTER APPLICATIONS

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JANUARY 1995

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NISEE/COMPUTER APPLICATIONS

NISEE/Computer Applications distributes computer software developed as a result of earthquake engineering and related research to a worldwide audience including professionals, academic researchers, government agencies, and the general public. Activities include dissemination of information about available computer programs, distribution of the programs, and educational seminars on the use of the programs.

User documentation and program packages are distributed. Program packages include the source code (unless specifically noted in the program description), sample input data, sample output and the user manual. The computer versions available for each program are listed with the program's summary. All of the programs are written in FORTRAN. All programs are available on magnetic tape, 5.25" DSDD or DSHD diskettes and 3.50" DSHD diskettes. Information on magnetic media options is included in the order information section.

Some of the programs require a license agreement for distribution. The program summary indicates if a license agreement is required and an asterisk is shown by the program name in the price list.

Besides the programs abstracted in this booklet, additional programs are available from NISEE. A list of some of the additional programs starts on page 75. Please contact NISEE for more information.

The suite of programs developed under the direction of Prof. Scordelis at the University of California at Berkeley for design and analysis of concrete box girder bridges and concrete structures is available through NISEE. A list of these programs starts on page 78.

Although these programs have been tested, no warranty is made regarding their accuracy or reliability. No responsibility is assumed by the authors, by NISEE, or by the University of California for any errors, mistakes, or misrepresentations that may occur from the use of these computer programs.

Public distribution of the programs through NISEE is made possible by the authors and the National Science Foundation. The ownership of the program remains with the developer. Royalty or development charges are not allowed for program distribution, and the programs should not be resold, in whole or in part, for a direct profit. Program requests by other organizations should be directed to NISEE/Computer Applications. The fee charged by NISEE covers the cost of distribution. This fee does not include consulting services for making the program operational on your computer.

We hope that this information will be of value to your organization and we look forward to serving you.

GENERAL NISEE INFORMATION

The National Information Service for Earthquake Engineering (NISEE), a public service project funded by the National Science Foundation, has been providing high-quality information services to earthquake engineering and related professionals for more than 20 years. NISEE at the California Institute of Technology (Caltech) maintains an Earthquake Engineering library. NISEE at the Earthquake Engineering Research Center (EERC), University of California at Berkeley is responsible for development and maintenance of the EEA Database, operation of an earthquake engineering lending library, collection and distribution of computer software, collection and distribution of earthquake engineering research publication abstracts, distribution of EERC research publications, and publication of the semiannual newsletter, the *EERC NEWS*. Please also note: an information request form is provided at the end of this booklet for your convenience.

EARTHQUAKE INFORMATION GOPHER

NISEE operates an earthquake information Gopher server which is accessible over the Internet at nisee.ce.berkeley.edu port 70. Earthquake information provided by NISEE and other organizations is available through the Gopher, along with a calendar of upcoming seminars and/or meetings. The EEA Database and Melvyl, the University of California Online Catalog, can be accessed from the Gopher. Selected strong-motion records are also available by anonymous ftp.

EARTHQUAKE ENGINEERING ABSTRACTS

Earthquake Engineering Abstracts produces and distributes the only comprehensive annual collection of abstracts and citations of current world literature pertinent to the fields of earthquake engineering and earthquake hazard mitigation. The abstracts are available in the Abstract Journal in Earthquake Engineering and online through the EEA Database. Each year more than 2,000 new items are added. Abstracts of technical papers, research reports, books, codes, and conference proceedings are obtained from 110 technical journals, and from the publications of academic, professional, and government organizations in 24 countries. For more information, please call **(510) 231-9468** or write.

EEA DATABASE

The EEA (Earthquake Engineering Abstracts) Database, formerly NISEE Database, is a specialized database devoted to coverage of the world's literature in earthquake engineering and earthquake hazards reduction. Informative abstracts and complete bibliographic citations make the EEA Database an invaluable reference tool. The database can be accessed online through the INTERNET network through MELVYL (the University of California Online Catalog), or one can request searches through the EERC Library. For more information, please call **(510) 231-9401** or write.

EERC LIBRARY

The EERC Library makes available to the engineering community and the general public its unique collection of materials relevant to earthquake hazards and their mitigation. The library has assembled more than 30,000 items which include research reports, technical journals, conference proceedings, monographs, slides, and maps. In addition to its major emphasis on earthquake engineering, the library's collection includes information in the related areas of seismology, geology, and disaster planning. Nontechnical publications on all aspects of earthquakes are also available. The EERC Library holdings can be searched through MELVYL. Interested persons are invited to telephone **((510) 231-9403 or 231-9401)**, visit, or write for information.

EERC REPORTS

Earthquake Engineering Research Reports are the published results of the research projects conducted at the Earthquake Engineering Research Center.These research reports are an on-going series which are available as individual copies or on an annual subscription basis. For more information, including a list of available reports and corresponding price list, or to order, please telephone **(510) 231-9468 or 231-9431,** or write.

EERC NEWS

The *EERC NEWS* highlights current activities of the NISEE program and research activities of the Earthquake Engineering Research Center. Each issue includes listings of new EERC Reports, recent library acquisitions, and announcements of new computer software. For more information please telephone **(510) 231-9468,** or write.

Direct inquires to each of these divisions at the following address:

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University of California, Berkeley
451 Richmond Field Station
1301 South 46th Street
Richmond, California 94804-4698

Fax: (510) 231-9461
E-mail: eerclib@eerc.berkeley.edu

OTHER BERKELEY SOFTWARE RESOURCES

Other resources for software and documentation at the University of California, Berkeley, are described below. All addresses are at the University of California, Berkeley, California 94720.

Berkeley UNIX

For information on purchasing 4.4 BSD UNIX, please contact:

Pauline Schwartz
Computer Systems Research Group
Computer Science Division
(510) 642-7780

Computer Science Division Publications

A list of documentation distributed by the Computer Science Division is available from:

Anne Fuller
Publications Office, Computer Science Division
387 Soda Hall
(510) 643-6619

EECS Industrial Liaison Program

The ILP program distributes software available from faculty research groups in the Department of Electrical Engineering and Computer Sciences at the University of California at Berkeley. For a catalog of software distributed, contact:

Barbara Allen
Industrial Liaison Program, Software Distribution Office
Electrical Engineering and Computer Sciences
Electronics Research Laboratory
205 Cory Hall
(510) 643-6687

Electronics Research Laboratory

The ERL Publications Office makes available to the engineering community and the general public its collection of documentation relevant to electrical engineering, including INGRES and POSTRES documentation. For a list of available technical reports with order and price information, please contact:

Jeff Wilkinson
Electronics Research Laboratory
253 Cory Hall, (510) 642-2301

EDUCATIONAL SOFTWARE

CAL 80(SD) . . . COMPUTER ANALYSIS LANGUAGE FOR THE STATIC AND DYNAMIC ANALYSIS OF STRUCTURAL SYSTEMS

DEVELOPED BY:

E. L. Wilson and M. I. Hoit
Department of Civil Engineering
University of California, Berkeley

MODIFIED BY:

F. Seible and C. T. Latham
Department of Applied Mechanics and Engineering Science
University of California, San Diego, La Jolla, California 92093

SUMMARY: CAL 80(SD) is an extensive modification of CAL78 which has options ranging from simple matrix manipulation, as an extension of classical structural analysis, to the direct stiffness formulation of structural systems, with extensions to dynamic analysis in the time or frequency domain. An accompanying program, SIMPAL, provides a transition to production-type programs for structural analysis by including options for data generation and geometry checks by screen plots. CAL 80(SD) operates as an interactive program but can also operate in batch mode by taking commands from an input file rather than a terminal. It is a database-driven program that is modularly constructed, with communication between each module controlled by a database manager. Small individual program segments, efficiently assembled by the use of run-time libraries and interconnected by a common database, allow applications not only on minicomputers and large mainframes, but also on microcomputer systems.

Operates on VAX computers.

USER GUIDE: Seible, F., and C. T. Latham, "CAL 80 - SIMPAL, Instructional Computer Programs for Structural Engineering, User Information Manual," Department of Applied Mechanics and Engineering Sciences, University of California, San Diego, January 1985.

CAL-91 . . . COMPUTER ASSISTED LEARNING OF STRUCTURAL ANALYSIS

DEVELOPED BY:

E. L. Wilson
Department of Civil Engineering
University of California, Berkeley

SUMMARY: The basic purpose of the CAL language is to bridge the gap between traditional methods of teaching structural analysis and the use of automated structural analysis programs. As a result of using CAL, it is hoped that engineers will understand the theory and approximations which are used in modern structural analysis programs. CAL-91 is designed to interpret a sequence of commands which are supplied by the user. The commands can be given directly in an "interactive mode," or the program can read the commands from a "batch data file." The input has been redesigned so all commands, array names, and data are in free-field form. Commands for matrix analysis, direct stiffness structural analysis, and dynamic response analysis are possible. The program is written in standard FORTRAN 77 and will operate on small microcomputers or large mainframe computers. Printer plots of results can be produced.

CAL-91 is used to perform linear dynamic analysis of small structural systems. It is possible to solve the following types of dynamic problems:

1. Evaluation of free-vibration mode shapes and frequencies.
2. Automatic generation of Ritz vectors to be used in mode superposition analysis or response spectra analysis.
3. Mode superposition analysis due to arbitrary loading.
4. Response spectra analysis due to earthquake loading.
5. Step-by-step analysis of structural systems with arbitrary viscous damping.

Operates on PC DOS and Apple MacIntosh computers.

USER GUIDE: Wilson, E. L., "CAL-91 - Computer Assisted Learning of Structural Analysis," Report No. UCB/SEMM-91/01, Department of Civil Engineering, University of California, Berkeley, January 1991.

STOCAL-I . . . STOCHASTIC COMPUTER ANALYSIS LANGUAGE FOR THE STATIC AND DYNAMIC ANALYSIS OF STRUCTURAL SYSTEMS

DEVELOPED BY:

M. R. Button, A. Der Kiureghian, and E. L. Wilson
Department of Civil Engineering
University of California, Berkeley

SUMMARY: STOCAL-I is a matrix interpretive language and a small capacity structural analysis program. It is an extended version of the CAL78 program that allows the nondeterministic analysis of structural response under uni-directional, arbitrarily angled base acceleration input. CAL78 is designed to manipulate arrays and matrices and to perform several standard structural analysis options. For STOCAL-I a series of nondeterministic operations have been added: discrete Fourier transform and inverse transform of any time history series; power spectral density calculations; input-output relationships in the frequency domain; complete quadratic combination techniques to give structural responses (displacements and forces) to prescribed inputs; and cumulative distribution functions evaluated for the peak of any response quantity. Source code written in Fortran 4. Originally programmed for CDC computers.

USER GUIDE: Button, M. R., A. Der Kiureghian, and E. L. Wilson, "STOCAL User Information Manual," Report No. UCB/SESM-81/02, Department of Civil Engineering, University of California, Berkeley, July 1981.

STOCAL-II . . . COMPUTER-ASSISTED LEARNING SYSTEM FOR STOCHASTIC DYNAMIC ANALYSIS OF STRUCTURES

DEVELOPED BY:

C. Wung and A. Der Kiureghian
Department of Civil Engineering
University of California, Berkeley

SUMMARY: STOCAL-II is an instructional software designed for teaching or self-learning of random vibrations and applied stochastic processes. It can be used in a classroom environment for demonstration purposes and homework assignments, or in an office environment for self-learning or for application to a variety of engineering problems. The software works in both interactive and batch modes and has an online graphics capability. It employs a command-based approach, where a problem is solved by issuing a sequence of commands with the appropriate matrices and parameters. The software functions as a transparent box involving decisions by the user, providing access to all intermediate results, and giving virtually unlimited flexibility for parametric study and experimentation. STOCAL-II is based on and is an extension of the well-known deterministic program CAL (Wilson, 1978), which has commands for matrix operations and for static and dynamic structural analysis, including formation of stiffness matrix, static condensation, eigenvalue analysis and time-history integration. The extension includes more than 40 commands for stochastic analysis, which are in ten groups as follows: (1) Two - dimensional graphics on display monitor and plotter; (2) Generation of random numbers and processes; (3) Transformation of sample numbers and functions; (4) Statistical estimation of sample numbers and functions; (4) Frequency and time-domain transformations; (6) PSD of stationary and nonstationary (evolutionary) response of linear systems; (7) Auto/cross-correlation of stationary and nonstationary (evolutionary) response of linear systems; (8) Spectral moments of stationary

response; (9) Engineering statistics of stationary process; and (10) Engineering statistics of nonstationary process.

STOCAL-II requires at least 420KB free memory and, for graphics, uses the IBM Graphics Toolkit. Thus, your system requires the proper VDI drivers for the display monitor and the plotter.

Operates on PC DOS computers. Source code not available; executable file only. License agreement required.

USER GUIDE: Wung, C.-D., and A. Der Kiureghian, "STOCAL-II: Computer Assisted Learning System for Stochastic Dynamic Analysis of Structures," Report No. UCB/SEMM-89/10, Department of Civil Engineering, University of California, Berkeley, California, April 1989.

STRUCTURAL ANALYSIS

BIAX . . . A COMPUTER PROGRAM FOR THE ANALYSIS OF REINFORCED CONCRETE AND REINFORCED MASONRY SECTIONS

DEVELOPED BY:

J.W. Wallace
Department of Civil Engineering, Clarkson University,
Potsdam, New York 13699-5710

SUMMARY: BIAX is a general purpose computer program to evaluate uniaxial and biaxial strength and deformation characteristics of reinforced concrete (R/C) sections. The program computes these characteristics based on the assumption that plane sections remain plane after the application of loading. Based on this assumption, the program can be used to compute strength or moment-curvature relations for uniaxial or biaxial monotonic loading. Nonlinear material models are used for both the reinforcing steel and the concrete. The model for the stress-strain behavior of the reinforcing steel is versatile, allowing relations that closely approximate experimentally observed behavior. Models for the concrete stress-strain behavior include the modified Kent and Park (1982), Sheikh and Uzumeri (1982), and Yong et al. (1988) relations. A stress-strain relationship for unconfined and confined masonry and user defined stress-strain relationships are incorporated. The relationship suggested by Vecchio and Collins (1986) is used to describe the stress-strain relation for concrete in tension. The tensile strength of the concrete beyond the rupture stress may be included or neglected. Presently, the program allows two stress-strain diagrams for concrete (unconfined and confined), and four relations for reinforcing steel (for any given problem).

An R/C section is described as a combination of rectangular subsections; therefore the program allows easy generation of T, L or barbell shaped sections. The user specifies a mesh for each subsection. An iterative procedure (simple bisection algorithm) is used to obtain a solution for the prescribed problem. Operates on PC DOS computers. Source code not available; executable file only.

USER GUIDE: Wallace, J.W., "BIAX: Revision 1, A Computer Program for the Analysis of Reinforced Concrete and Reinforced Masonry Sections," Report No. CU/CEE-92/4, Department of Civil Engineering, Clarkson University, Potsdam, New York, February 1992.

ETABS . . . EXTENDED THREE-DIMENSIONAL ANALYSIS OF BUILDING SYSTEMS

DEVELOPED BY:

E. L. Wilson, J. P. Hollings, and H. H. Dovey
Department of Civil Engineering
University of California, Berkeley

SUMMARY: ETABS is designed to perform linear structural analysis of frame and shear wall buildings subjected to both static and earthquake loadings. The building is idealized by a system of independent frame and shear wall elements interconnected by floor diaphragms which are rigid in their own plane. Frame and shear wall elements of arbitrary plan may be specified, within which full kinematic compatibility is enforced. Bending, axial, and shearing deformations are included within each column. Beams, girders, and vertical diagonal braces may be nonprismatic, and bending and shearing deformations are included. Special panel elements allow discontinuous shear walls to be modeled. Finite column and beam widths are included in the formulation. Nonsymmetric, nonrectangular buildings that have frames and shear walls located arbitrarily in plan can be considered. Axial deformations of common column lines of different frames are treated as uncoupled by the program.

Three independent vertical and two lateral static loading conditions are possible. The static loads may be combined with a lateral earthquake input that is specified either as an acceleration spectrum response or as a ground acceleration record.Three-dimensional mode shapes and frequencies are evaluated.

Frame and shear walls are considered as substructures in the basic formulation; therefore, for many structures input data preparation can be minimized and a significant reduction in computational effort can result.The following output is given by the program: story displacements, mode shapes and periods, lateral frame displacements, frame member forces at each level of the frame. Results can be printed for as many modes under consideration as are desired.

Operates on CDC and IBM mainframe and DECstation 3100 computers.

USER GUIDE: Wilson, E. L., J. P. Hollings, and H. H. Dovey, "Three-Dimensional Analysis of Building Systems," Earthquake Engineering Research Center, Report No. UCB/EERC-75/13, University of California, Berkeley, April 1975.

ODRESB-3D . . . OPTIMUM DESIGN OF REINFORCED CONCRETE AND STEEL BUILDING SYSTEMS SUBJECTED TO 3-D GROUND MOTIONS AND ATC-03 PROVISIONS

DEVELOPED BY:

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SUMMARY: The building system to be optimized can consist of any combination of steel columns, beams, and braces and reinforced-concrete flexural walls and panels. Each floor is assumed to be rigid in its own plane. Second order effects are handled with two different approaches. The static and response spectrum analyses use a separate geometric stiffness matrix, while the ATC 3-06 analysis uses a stability factor in order to adjust the structural response.

The program has the option of adding external or nonstructural stiffness to the structural stiffness. An objective function is minimized, either cost or weight, subject to the constraints of the analyses chosen. Primary design variables for reinforced concrete or for steel wide-flange sections are computed, from which appropriate design values for members may be selected.

Operates on IBM mainframe and Fujitsu VP computers.

USER GUIDE: Truman, K. Z., D.-S. Juang and F. Y. Cheng, "ODRESD-3D User's Manual, A Computer Program for Optimum Design of Reinforced Concrete and Steel Building Systems Subjected to 3-D Ground Motions and ATC-03 Provisions," Department of Civil Engineering, University of Missouri-Rolla, Civil Engineering Study Structural Series 85-30, 1985.

ODSEWS-2D-II . . . OPTIMUM DESIGN OF 2-D STEEL STRUCTURES FOR STATIC, SEISMIC AND WIND FORCES

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SUMMARY: The structural system to be optimized can be trusses, unbraced and braced frames. Seismic input can be one-dimensional (horizontal) and two-dimensional (horizontal coupled with vertical). The dynamic forces may be seismic excitation at the base, dynamic forces applied at the structural nodes, and wind forces acting on the structural surfaces. The seismic input excitations include earthquake time histories, five groups of response spectra, and three seismic design code provisions: the Uniform Building Code, the Chinese Seismic Design Code, and ATC-3-06. The structural formulation is derived on the basis of the matrix displacement method and consistent mass method with the

second order P-Δ forces included. The constituent members of a system are made of either built-up sections or of AISC WF sections. Constraints include stresses, displacements, story drifts, natural frequencies, maximum differences between relative stiffnesses, and lower bound of cross sections. The objective function can be either minimum weight or minimum cost.

Operates on IBM mainframe and Fujitsu VP computers.

USER GUIDE: Cheng, F. Y., and D.-S. Juang, "ODSEWS-2D-II User's Manual, A Computer Program for Optimum Design of 2-Dimensional Steel Structures for Static, Seismic and Wind Forces," Department of Civil Engineering, University of Missouri-Rolla, Civil Engineering Study Structural Series 85-11, 1985.

RCCOLA . . . REINFORCED CONCRETE COLUMN ANALYSIS

DEVELOPED BY:

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SUMMARY: The computer program RCCOLA will evaluate the general flexural characteristics of reinforced concrete cross-sections subjected to axial forces and uniaxial bending moments. The constituent relationships considered for the concrete and reinforcement are general, single-valued functions of strain (i.e., stress unloading not considered). The geometry of the section may be arbitrary, except that an axis of symmetry must exist perpendicular to the neutral axis of the section. Plane sections are assumed to remain plane after deformation, and bond slip between the concrete and the reinforcement is disregarded.

For each combination of axial load and concrete strain (in the extreme compression fiber) specified by the user, the following are evaluated: (1) the shear strength near the section according to ACI recommendations, (2) the moment at the end of an asymmetrically loaded member that corresponds to this shear strength, and (3) the moment capacities corresponding to (a) tensile yielding in the reinforcement, (b) compression yielding in the reinforcement, and (c) fracture of the tensile reinforcement.

Source code in FORTRAN 4. Originally programmed for CDC computers.

USER GUIDE: Mahin, S. A., and V. V. Bertero, "RCCOLA, A Computer Program for Reinforced Concrete Column Analysis, User's Manual and Documentation," Department of Civil Engineering, University of California, Berkeley, August 1977.

RCSA . . . REINFORCED CONCRETE SECTION ANALYSIS

DEVELOPED BY:

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SUMMARY: RCSA is an interactive microcomputer program developed to provide a practical and reliable section analysis tool to predict the response of deep or flanged RC sections. Some components of an existing program, UNCOLA, which was developed at the University of California, Berkeley, were incorporated into RCSA. With RCSA one is able to perform analysis of a prestressed, reinforced concrete, or a composite section at any limit state under any specified loading history.

The program utilizes the layer, or filament, approach to discretize a section. Assumptions in the analysis are as follows: (1) The section must be loaded through an axis of symmetry by unidirectional axial force, flexure and shear; (2) Any type of user-defined strain profile, as well as the Bernoulli-Nairer hypothesis, may be implemented. Even "bond slip" or "shear-lag" may be simulated by properly defining strain coefficients for steel or concrete fibers and/or filaments; (3) Shear force and/or shear deformation relations are not explicitly included; however, the effect of shear on axial-flexural response may be considered through an equivalent bi-axial response for concrete; (4) Perfect bond between steel and concrete exists unless slip is incorporated by defining slip factors for individual bars; (5) Narrow cracks and microcracking that may exist as initial conditions may be accounted for by modifying concrete material properties; and (6) Other initial stresses and/or bond slip which may be existing as a result of construction or curing effects are neglected. Initial prestressing effects in steel may be incorporated if prestressing is specified and a bilinear model for steel is used.

Operates on PC DOS computers.

USER GUIDE: Nelson, G., and A. E. Aktan, "Response Prediction of Wall and T-Beam Elements in RC Buildings and User's Guide for 'RCSA'," Department of Civil Engineering, Research Report 86-3, Louisiana State University, Baton Rouge, Louisiana, July 1986.

SAP IV . . . A STRUCTURAL ANALYSIS PROGRAM FOR STATIC AND DYNAMIC RESPONSE OF LINEAR SYSTEMS

DEVELOPED BY:

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SUMMARY: SAP IV is a finite element structural analysis program for the static and dynamic response of linear three-dimensional systems. The program is written to analyze structures which are idealized by combinations of structural element types. The capacity of the problem depends mainly on the number of finite element nodal points in the system. There is practically no restriction on the number of elements, the number of load cases and the number or bandwidth of the equations to be solved. In a dynamic analysis the options are (1) frequency calculations, (2) frequency calculations followed by response history analysis, (3) frequency calculations followed by response spectrum analysis and (4) response history analysis using step-by-step direct integration. Despite large system capacity, no loss in efficiency is encountered in solving smaller problems. The report describes the logical construction of the program, the dynamic high speed storage allocation, the analysis capabilities, the finite element library and the numerical techniques used. The report also contains the user's manual.

The following element types are available:

- Three-dimensional truss
- Three-dimensional beam
- Plane stress and plane strain
- Two-dimensional axisymmetric solid
- Three-dimensional solid (8 node brick)
- Plate and shell
- Boundary
- Pipe
- Variable-number-nodes thick shell and
  Three-dimensional element

Operates on CDC and IBM mainframes, VAX and Fujitsu VP computers.

USER GUIDE: Bathe, K-J., E. L. Wilson, and F. E. Peterson, "SAP IV - Structural Analysis Program for Static and Dynamic Response of Linear Systems," Earthquake Engineering Research Center, University of California, Berkeley, Report No. 73-11, June 1973; revised April 1974.

SLAM-2 . . . A MICROCOMPUTER PROGRAM FOR THE ANALYSIS OF STRUCTURAL POUNDING

DEVELOPED BY:

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SUMMARY: Buildings dynamically sway during an earthquake, and lateral collisions can occur between structures that are in close proximity to each other.

This is referred to as structural pounding. SLAM-2 is intended to provide practicing engineers with an analytical tool that can be used to evaluate the effects of structural pounding on buildings. SLAM-2 is an extension of the computer program SLAM(1988). SLAM was for the analysis of pounding between a flexible three dimensional multistory building and a rigid adjacent structure. SLAM-2 is for the analysis of pounding between two flexible three dimensional multistory buildings. The buildings are idealized using the ETABS formulation as contained in the enhanced microcomputer version, SUPER-ETABS. The data generated by SUPER-ETABS via a restart file is used by SLAM-2.

A SLAM-2 analysis is typically carried out in three steps: (1) a SUPER-ETABS solution for the first building's stiffness properties; (2) a SUPER-ETABS solution for the second building's stiffness properties; and (3) a SLAM-2 time history solution for the building pounding response. SLAM-2 also has a restart capability which saves the buildings' stiffnesses and dynamic properties thereby permitting rapid execution of multiple response time history analyses.

SLAM-2 solves for each building's gross story response quantities: deflections, twists, drifts, shears, torques, and overturning moments. Envelopes of the peak positive and negative responses and the relative time of occurrence are output. The program can also printer plot the peak response envelopes along each building's height. The user can request saving the time history of each response quantity for later post processing.

The program is available either as (1) an addition to the SUPER-ETABS program, which the user must modify on his own, or (2) as a complete program package contained within SUPER-ETABS.

Operates on PC DOS computers.

USER GUIDE Maison, B.F. and K. Kasai, "SLAM-2 - A Computer Program for the Analysis of Structural Pounding," August 1990.

SUPER-ETABS . . . EXTENDED THREE-DIMENSIONAL ANALYSIS OF BUILDING SYSTEMS

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SUMMARY: SUPER-ETABS is an enhancement of ETABS which was designed to perform linear structural analysis of frame and shear wall buildings subjected to both static and earthquake loadings. The extended capabilities of the enhanced program include: the analysis for the gross building response quan-