

**PACKAGE ID** - 000605SPARC00 CCLAMP

**KWIC TITLE** - Cryogenic Current Lead Analysis Model Program

**AUTHORS** - Demko, J.  
Superconducting Super Collider Laboratory, Dallas, TX  
(United States)

Carcagno, R.  
Superconducting Super Collider Laboratory, Dallas, TX  
(United States)

Schiesser, W.E.  
Lehigh University, Bethlehem, PA (United States)

**LIMITATION CODE** -COPY                   **AUDIENCE CODE** - LIM

**COMPLETION DATE** - 01/01/1992   **PUBLICATION DATE** - 01/01/1992

**DESCRIPTION** - CCLAMP was developed to provide a tool for the analysis of superconducting or normal current leads used to supply electricity from a warm interface (usually room temperature) to a device at cryogenic temperatures. It determines the heat leak to the cryogenic connection and the mass flow of the cryogen (typically helium) for the lead and installation modelled. It may be used to thermally optimize a lead design for a particular application. The user provides relevant geometry details to model the electrical (length, diameter, superconducting length) and heat exchanger design of the lead (heat transfer coefficient, heat transfer area). It has a transient analysis capability so that lead transients such as cool down, current ramping, flow disruptions, and control simulations can be performed.

**PACKAGE CONTENTS** - Media Directory; Software Abstract; Media Includes Source Code, Sample Problem Input and Output;

**SOURCE CODE INCLUDED?** - Yes

**MEDIA QUANTITY** - 1 3.5 Diskette

**METHOD OF SOLUTION** - The one dimensional transient energy equation with heat generation for the lead and the cryogen (helium) are solved simultaneously using the numerical method of lines. In the method of lines, the spatial differences in the energy equations are approximated with finite differences and the temporal derivatives are integrated using the LSODES (ESTSC 216) ordinary differential equation solver. One additional ordinary differential equation for a proportional integral control loop is coded in the program so that CCLAMP can be used to simulate mass flow control algorithms based on a set point temperature for the lead 6.

**COMPUTER** - SUN SPARC

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**OPERATING SYSTEMS** - Machine Dependent

**PROGRAMMING LANGUAGES** - FORTRAN77

**SOFTWARE LIMITATIONS** - The user must supply their own property packages for the cryogenics (Helium, Nitrogen, etc.). An interface routine is included which may be customized for a particular property package.

**SOURCE CODE AVAILABLE (Y/N)** - Y

**UNIQUE FEATURES** - It is a general treatment of the transient analysis of cryogenic current leads. It provides a coolant flow control capability.

**OTHER PROG/OPER SYS INFO** - All of the source code files are filename.f. A sample input and output are contained in SEND.OUT. Differences in level of FORTRAN 77 compliance from mainframe, SUN, and PC based compilers, revealed minor errors and warnings.

**HARDWARE REQS** - Has been run on workstations. Other size requirements not available.

**TIME REQUIREMENTS** - A 26 node case may take between 5-15 minutes of CPU time on a SUNN SPARC station 2 for a transient case with mass flow control simulation.

**ABSTRACT STATUS** - Submitted August 20, 1993. Released AS-IS September 15, 1993.

**SUBJECT CLASS CODE** - H

**KEYWORDS** -

COMPUTER PROGRAM DOCUMENTATION  
C CODES  
THERMAL ANALYSIS  
HEAT TRANSFER  
DESIGN  
OPTIMIZATION  
CRYOGENICS  
SUPERCONDUCTING WIRES

**EDB SUBJECT CATEGORIES** -

990200 420400 665412

**SPONSOR** - DOE/ER

**PACKAGE TYPE** - AS - IS