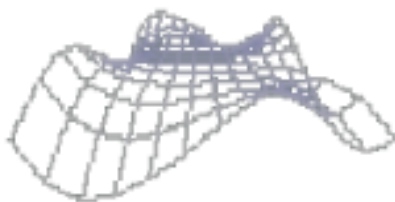


INT48pro
labcad

*Calculus
for
Students, Scientists and
Engineers*



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INT48PRO LABCAD V1.53β

User's Guide and Manual

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Special Thanks to:

Hewlett Packard HP48G Series Development Team

Super powerful BCD Saturn CPU.

Manuals: SYSRPL and ML

Eduardo Kalinowski

Manuals: SYSRPL and ML

Fernandes Henri Gilbert

Manuals: Introduction to Saturn Assembly Language

Eric Rechlin

Manuals: Introduction to Saturn Assembly Language

Mika Heiskanen

Manuals: SYSRPL and ML

ALG48: PF, RORD, FCTR, and RSIM command

JAZZ: Programming and debugging for SYSRPL and ML

Claude-Nicolas Fiechter

ALG48: PF, RORD, FCTR, and RSIM commands

Raymond Hellstern

Apndvarlst: routine in ML

Detlef Mueller

Apndvarlst: routine in ML

Author of GZ

Compression utility that is fast, used to compress tables in the next version.

Thanks to:

Hewlett Packard HP48G Series Development Team:

Excellent internal software

All that use INT48pro

Eduardo Kalinowski

Bernard Parisse

Mika Heiskanen

Eric Rechlin

Raymond Hellstern

Detlef Mueller

Esra Neufeld

Camillo Toselli

William Storey

Many Many Others

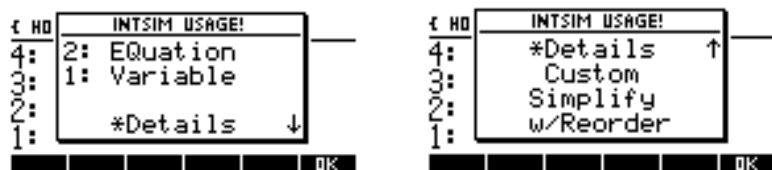
Before you begin:

INT48pro requires itself and ALG48 be installed on your HP48G Series R version only as well as one or all the modules shipped with this version! This program and all of its components are copyrighted (c) by Jeremy Eli Laughery. INT48pro is an alpha version meaning that no argument checking is done at this time. I have provided a list of commands and stack diagrams that are ok to use if used correctly. I have spent about 3000 hours researching and developing INT48pro learning RPL, SYSRPL, and ML. I enjoy working with this program for it is a challenge to conquer! As time goes by, I will add several hundred new forms to INT48pro and new external libraries as plug-in modules too. INT48pro is not nearly finished and has non-critical errors in several of the forms that will be fixed in the next version. The most powerful of the external libraries is the LAPLACE transform plug-in which will be talked about later. Next comes the Z transform plug-in then the INTEGRATION plug-in. I expect the INTEGRATION plug-in to be the most powerful of all when INT48pro is complete. INT48pro is my first "real" artificial intelligence system (AIS). I hope all that use INT48pro find it as amazing as I find it. Please do not hack nor port this program to another machine, let the author do that. This document will look better in the future.

Usage: [See also Examples.pdf](#)

Input and Error checking:

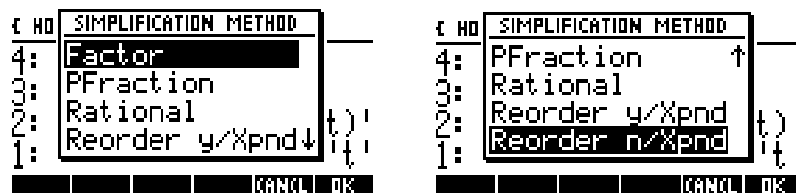
INT48pro has a new feature that allows error checking be done in 100% ML. You may choose to have nothing on the stack before pressing any of the commands below to invoke a user-friendly screen that gives the argument type and stack level expected for each command as well as the command's details in most cases. The new user-friendly screen will also be invoked if not enough or the wrong arguments are on the stack. See below for an example.



Simplification:

INTSIM

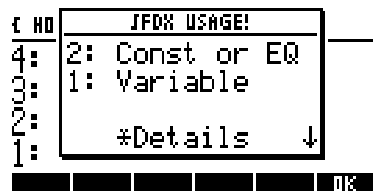
With this powerful command, you may perform pre-simplification on expressions reordering them with respect to a variable VX. This command calls a special routine designed by me and is written in 30% ML applying RSIM and RORD from ALG48 (with other reorder routines designed by me) whenever possible.



Calculus:

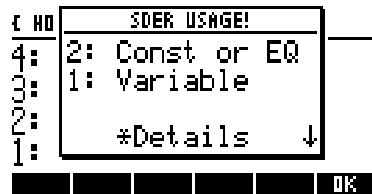
lfdx

You can perform integration of many functions that are not natively solved by the HP48.



SDER

You can find derivatives with INT48pro and keep the result symbolic because INT48pro returns only symbolic results but uses the power of the internal derivative engine to do the hard work.



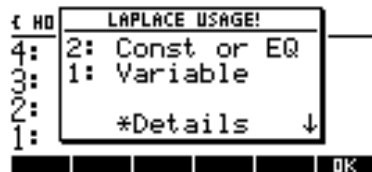
III

Perform multiple integration wrt { X,Y } or { X,Y,Z } **near future**

Integral Transformations:

LAP

Find Laplace transforms of many functions encountered in science, engineering and physics.



ILAP

Find the inverse Laplace transform given an equation in the frequency domain for many systems.



Fourier

Later version

[IFourier](#)

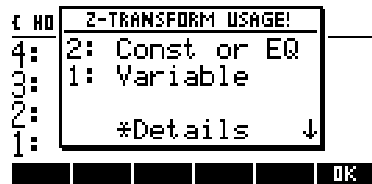
Later version

[FSeries](#)

Later version

[Z-trn](#)

Find the Z transform of many time-domain functions used in controls engineering, physics and more.



[IZ-trn](#)

Later version

Coordinate Transformations:

[\$X \leftrightarrow r\$](#)

Use this command to transform a rectangular system to a spherical system or a spherical system to a rectangular system.

[\$X \leftrightarrow \rho\$](#)

Use this command to transform a rectangular system to a cylindrical system or a cylindrical system to a rectangular system.

[\$\rho \leftrightarrow r\$](#)

Use this command to transform a cylindrical system to a spherical system or a spherical system to a cylindrical system.

Vector Calculus:

[\$\nabla \cdot A\$](#)

Divergence of A

List on 2: List on 1: -> List

$\nabla \times A$

Curl of A

List on 2: List on 1: -> List

∇V

Gradient of a scalar V

Expression on 2: List on 1: -> List

$\nabla^2 V$

Laplacian of a scalar V

Expression on 2: List on 1: -> List

Sym

Later version

Symx

Later version

Orthogonal Polynomials:

Legendre

Tchebysheff, First kind

Tchebysheff, Second kind

Jacobi

Laguerre

Hermite

All orthogonal commands are accessible by the interface similar the one below.



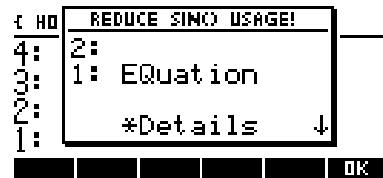
Trigonometry:

SCT

Converts SEC, CSC, COT, SECH, CSCH, COTH, ASEC, ACSC, ACOT, ASECH, ACSCH and ACOTH to SIN, COS and TAN etc.

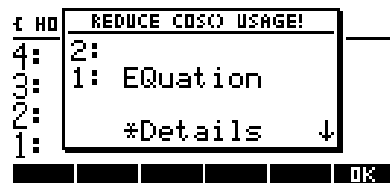
↓SIN

Reduces powers of SIN to linear powers and combinations of SIN and COS. 50% ML



↓COS

Reduces powers of COS to linear powers and combinations of SIN and COS. 50% ML



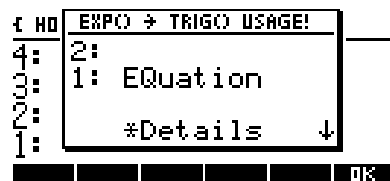
→EXP

Converts sinusoidals to EXP(). 20% ML



EXP→

Converts EXP() to sinusoidals.



↑EXP

Pushes exponentials out of the denominator and into the numerator whenever possible, reduces powers of exponentials by multiplying the argument of EXP() by its power then collects multiple exponentials by adding their arguments. 100% PCO/ML



↓EXP

Expands exponentials by splitting their argument into single arguments then applies EXP() to each.



→EXPH

Converts all sinusoidals to EXPH() **Later version**

SINCOS

Converts all sinusoidals to SIN() and COS() only

SCHYP

Converts all hyperbolic sinusoidals to SINH() and COSH() only

→SIN

Converts all sinusoidals to SIN() only

→COS

Converts all sinusoidals to COS() only

→SINH

Converts all hyperbolic sinusoidals to SINH() only

→COSH

Converts all hyperbolic sinusoidals to COSH() only

Algebra:

All algebra commands will be available in the near future.

AL

AR

DL

DR

ML

MR

Special Functions:

$J_{1/2 \pm n}$

Half-order Bessel function

Utilities:

BMRK

Benchmark program I wrote for the timing of all INT48pro commands.

Put the command inside delimiters << command >> then press BMRK to run.

All remaining commands are left until I have time to rewrite in ML and debug them.
IZ-trans, FOURIER and IFOURIER will not be available in this version but will be in the next to come.

About INT48pro:

- * INT48pro was written and developed by Jeremy Eli Laughery.
- * Written in 30% assembler, 50% PCO and 20% SYSRPL.
- * INT48pro can search over 1000 forms in less than a second!
- * INT48pro has what I call Symbolic Manipulation Application Reuses Tables (SMART) forms which is a recognition system designed by Jeremy Eli Laughery allowing smaller table sizes and the same power! SMART forms recognizes shifts and multiples of VX when doing LAP and Z-trans only at this time. This feature will be improved in the future to extend the already powerful features.
- * INTEGRATION handles about 170 forms at this point.
- * LAPLACE handles about 130 forms at this point.
- * ILAP handles 40 forms at this point.
- * Z-trans handles about 120 forms at this point.
- * Size is 75K Bytes with all modules installed.
- * I plan for INT48pro to be written in 100% assembler when completed.
- * Source is not available at this time.

Future of INT48pro:

- * Advanced Search Technology (AST) developed by me can search tables upto twice as fast. Please see AST.pdf for more details.
- * Fix and complete the INTEGRATION tables.
- * Implement Semi-Dynamic Structure (SDS).
- * Add more LAPLACE, ILAPLACE and Z tables.
- * Add INVZ, FOURIER and IFOURIER tables as libraries of their own.
- * Add FSeries (Fourier Series) tables as a library.
- * Learn more ML.

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IF you really need to call me

THEN email me for my # and visit my Homepage.

ELSE back-up your HP and enjoy using INT48pro beta version.

Jeremy E. Laughery