INT48pro labcad

Examples

Documentation

I will update this file with new examples of what you can do with INT48pro labcad. Here are few to start with:

Simplification:

You can simplify expressions with INT48pro with the INTSIM command.

Ex: $\frac{\sqrt{(A+SIN(t))}}{5}$ wrt 't'

After INTSIM Rational $\rightarrow \frac{1}{5}\cdot\sqrt{(SIN(t)+A)}$

Differentiation:

You can take symbolic derivatives with INT48pro. This uses the built-in power of the HP48GX and is augmented by my routines to preserve symbolics and are semi-simplified i.e. powers of i are not collected.

Integration:

This command lets you perform integration of 170 or so different forms and all linear combinations of those forms.

You can integrate these equations for example:

$5\cdot COS(10\cdot t)^{n}$ wrt 't' where n is real, (even or odd)

$\sqrt{\frac{2}{3}}\cdot SIN(10\cdot t)^{5}$ wrt 't' where n is real, (even or odd)

$10\cdot SIN(3\cdot t)\cdot SIN(20\cdot t+30)\cdot e^{5\cdot t}$ wrt 't'

Laplace transforms:

This command lets you perform Laplace transforms of 130 or so different forms and all linear combinations of those forms.

You can take Laplace transforms that use SMART forms:

$5 \cdot \mathrm{COSH}(10 \cdot t) \cdot e^{2 \cdot t}$ wrt ‘t’ shift in frequency

$t \cdot \mathrm{SINH}(\sqrt{2} \cdot t) \cdot e^{2 \cdot t}$ wrt ‘t’ differentiation and shift in frequency

Inverse Laplace transforms:

You can take the inverse Laplace transform with INT48pro.

This command lets you perform INV Laplace transforms of 40 or so different forms and all linear combinations of those forms.

$$\frac{\frac{1}{10}}{(s^2+5)^n}$$ wrt 's' where n is real and positive

this uses the half-order Bessel function.

$$\frac{2\cdot s}{(s^2+2\cdot s+5)^2}$$ wrt 's'

$$\frac{1}{(\text{quadratic})^n}$$ wrt 's' where n is real and positive

Ex:

$$\frac{1}{(s^2+2\cdot s+5)^5}$$ wrt 's'

$$\frac{s}{(\text{quadratic})^n}$$ wrt 's' where n is real and positive

Ex:

$$\frac{s}{(s^2+3\cdot s-5)^2}$$ wrt 's'

With semi-dynamic structure SDS, you can take inverse Laplace transforms of even more complex equations in the frequency domain.

$$\frac{s^3+s+1}{(\text{quadratic})^n}$$ wrt 's' where n is real and positive

Ex:

$$\frac{s^3+s+1}{(s^2+3\cdot s-5)^2}$$ wrt 's'

Z-transforms:

This command lets you perform Z transforms of 120 or so different forms and all linear combinations of those forms.

You can take the Z transform using SMART forms:

$50 \cdot \mathrm{SINH}(\sqrt{7} \cdot t) \cdot e^{4 \cdot t}$ wrt ‘t’ shift in the Z domain

$20 \cdot t \cdot \mathrm{COSH}(3 \cdot t) \cdot e^{2 \cdot t}$ wrt ‘t’ differentiation and shift in the Z domain

You may perform Symbolic coordinate transformations with INT48pro.
There are only three commands to do all six conversions!
$X \leftrightarrow r$, $X \leftrightarrow \rho$, $\rho \leftrightarrow r$

note: the double-arrow means to and from.

This is how you would use each command:

Coordinate Transformations 101

Think of the three most commonly used coordinate systems as a tri-cycle. You can move from one coordinate system to another from anywhere you are.

```
        X, Y, Z
           |
           +
          / \
  ρ, ϕ, Z     r, θ, ϕ
```

I use the + symbol to denote a relationship with each system. You can replace the + symbol with the current state (coordinates) the system is represented by. The algorithms used in INT48pro implement my methodology of transformations.

end of class :)

1. Put a list on the stack with the equations that represent the system.
   Ex: { X Y Z }
2. Put a list on the stack that represents the state you are in i.e. the present coordinates. from the first step, we will use:
   { X Y Z }; the state (coordinates) we are in.
3. Press the command of the conversion you would like to perform.
   Ex: I want to transform my system into{ r, θ, ϕ }coordinates so I would press the command $X \leftrightarrow r$.

solution after RSIM is applied:

X: r =
$r*\sin(\theta)^2*\sin(\phi)^2+r*\sin(\theta)^2*\cos(\phi)^2+ r*\cos(\theta)^2$

Y: θ =
$r*\sin(\theta)*\sin(\phi)^2*\cos(\theta)+r*\sin(\theta)* \cos(\theta)*\cos(\phi)^2-r*\sin(\theta)*\cos(\theta)$

Z: ϕ =
0

To go back to the X,Y, Z system put {r θ ϕ} on the stack and press X↔r again then use RSIM to simplify.

You can perform Symbolic: Divergence, Curl, Gradient and Laplacian math with INT48pro.

Divergence:

1. Put a list with the expressions that represent the system onto stack level 1.

   Ex: { X^2 Y^2 Z^2 }
2. Put a list on the stack that represents the state you are in i.e. the present coordinates.

   from the first step, we will use:

   { X Y Z }; the state (coordinates) we are in.
3. Press the ∇•A (divergence) command

   solution:

   $2 \cdot X + 2 \cdot Y + 2 \cdot Z$

Curl:

1. Put a list with the expressions that represent the system onto stack level 1.

   Ex: { X^2 Y^2 Z^2 }
2. Put a list on the stack that represents the state you are in i.e. the present coordinates.

   from the first step, we will use:

   { X Y Z }; the state (coordinates) we are in.
3. Press the ∇ x A (curl) command

   solution:

   { 0 0 0 }

Gradient:

Gradient of a scalar field 101

The gradient of a scalar field is a vector.

1. Put an expression that represent the system onto stack level 1.

   Ex: $X^2 + Y^2 + Z^2$
2. Put a list on the stack that represents the state you are in i.e. the present coordinates.

   from the first step, we will use:

   { X Y Z }; the state (coordinates) we are in.
3. Press the Gradient command ∇’V

   solution:

   { $2 \cdot X$ $2 \cdot Y$ $2 \cdot Z$ }

Laplacian:

Laplacian of a scalar field 101

The Laplacian of a scalar field is a scalar.

1. Put the expression that represent the system onto stack level 1.
   Ex: $X^2 + Y^2 + Z^2$
2. Put a list on the stack that represents the state you are in i.e. the present coordinates.
   from the first step, we will use:
   { X Y Z }; the state (coordinates) we are in.
3. Press the Laplacian command (∇’’V)
   solution:
   6

You can perform trigonometric math with INT48pro labcad.

SCT:

With this powerful command, you can transform any trigonometric expression into SIN( ), COS( ) and TAN( ) only.

Ex:

$\mathrm{ACOT}(t) \rightarrow \mathrm{SCT}$ becomes $\mathrm{ATAN}(t)^{-1}$

$\mathrm{ACSCH}(t) \rightarrow \mathrm{SCT}$ becomes $\mathrm{ASINH}(t)^{-1}$

↓SIN:

You can reduce powers of SIN( ).

Ex:

$\mathrm{SIN}(\sqrt{2} \cdot t)^3 \rightarrow \downarrow\mathrm{SIN}$ becomes

$$\frac{1}{4} \cdot (-\mathrm{SIN}(3 \cdot \sqrt{2} \cdot t) + 3 \cdot \mathrm{SIN}(\sqrt{2} \cdot t))$$

↓COS:

This command does the same as above but with powers of COS( )

↑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.

Ex:

$$\frac{\mathrm{COS}(a \cdot t) \cdot e^{a \cdot t}}{e^{i \cdot omega \cdot t}} \rightarrow \uparrow\mathrm{EXP}$$

result: $\mathrm{COS}(a \cdot t) \cdot e^{a \cdot t + -1 \cdot i \cdot omega \cdot t}$

↓EXP:

Expands an exponential by splitting its argument into single arguments then applies EXP( ) to each.

Ex:

$e^{A + B + t} \rightarrow \downarrow\mathrm{EXP}$

result: $e^{A} \cdot e^{B} \cdot e^{t}$

SINCOS:

This command converts all trigonometric operators to SIN( ) and COS( ).

SCHyp:

Same as above but with hyperbolics.

→SIN:

Convert all sinusoids to SIN( ) only

→COS:

Convert all sinusoids to COS( ) only

→SINH:

Convert all hyperbolic sinusoids to SINH( ) only

→COSH:

You may obtain orthogonal polynomials with INT48pro by using an interactive menu.

The following orthogonal polynomial relations may be found:

Legendre(n,VX)

this needs n and VX on the stack or it will crash!

Chebysheff, First kind(n,VX)

this needs n and VX on the stack ....

Chebysheff, Second kind(n,VX)

this needs n and VX on the stack.....................

Jacobi(a,b,n,VX)

this needs a, b, n and VX on the stack................

Laguerre(a,n,VX)

this needs a, n and VX on the stack...................

Hermite(n,VX)

this needs n and VX on the stack.......................

This is not all you can do with INT48pro labcad. These are just examples you can do. All tables of INT48pro are set-up with order-of-complexity meaning I don't just throw something in there without putting the less complex forms first. For example, I will put $A \cdot SIN(B \cdot VX)^n$ in the tables before I would $A \cdot VX \cdot SIN(B \cdot VX)^n$ and so on etc, etc. becoming more complex as I implement each form.