

# PHC OX server Manual

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# 1 PHC Functions

This chapter describes interface functions for PHC pack `ox_sm1_phc`. These interface functions are defined in the file `phc.rr`. The file `phc` is at `$(OpenXM_HOME)/lib/asir-contrib`.

```
[255] phc.start();
0
[257] phc.phc([x^2+y^2-4,x*y-1]);
The detailed output is in the file tmp.output.*
The answer is in the variable Phc.
0
[260] Phc ;
[[[-0.517638,0],[-1.93185,0]],
[[1.93185,0],[0.517638,0]],
[[-1.93185,0],[-0.517638,0]],
[[0.517638,0],[1.93185,0]]]
[261]
```

Author of PHC pack: Jan Verschelde. <http://www2.math.uic.edu/~jan/download.html> Reference 1: Jan Verschelde, "PHCpack: A general-purpose solver for polynomial systems by homotopy continuation". ACM Transaction on Mathematical Softwares, 25(2): 251-276, 1999.

Reference 2: Cox, D., O'Shea, Little, J., Using Algebraic Geometry, Springer. See the chapter on mixed volumes.

## 1.1 Functions

### 1.1.1 `phc.start`

```
phc.start()
:: Start ox_sm1_phc on the localhost.
```

*return* Integer

- Start `ox_sm1_phc` on the localhost. It returns the descriptor of `ox_sm1_phc`.
- Set `Xm_noX = 1` to start `ox_sm1_phc` without a debug window.
- The descriptor is stored in `Phc_proc`.

```
P = phc.start()
```

Reference

```
ox_launch, phc
```

### 1.1.2 `phc.phc`

```
phc.phc(s|proc=p)
:: Ask PHC pack to find all the roots in the complex torus of the given systems
of polynomials s
```

*return* Void

$p$             Number

$s$             List

- The server calls PHC pack to solve a system of algebraic equations  $S$  by homotopy methods. PHC pack has been developed by Jan Verschelde. See [www.mth.msu.edu/~jan](http://www.mth.msu.edu/~jan) for the original distribution. The original PHC pack can choose several strategies to solve, but our phc interface uses only black-box solver, which is general and automatic but is not efficient. So, if you fails by our interface, try the other strategies via the original user interface.
- phc generates working files tmp.phc.out.pid, tmp.input.\*, tmp.output.\*. Here, pid the process number of the server. The file tmp.output.\* contains details informations on how PCH pack solves the system.
- The number of variables and the number of equations `length(s)` must agree.

Algorithm: Jan Verschelde, PHCpack: A general-purpose solver for polynomial systems by homotopy continuation". ACM Transaction on Mathematical Softwares, 25(2): 251-276, 1999.

```
[232] P = phc.start();
0
[233] phc.phc([x^2+y^2-4,x*y-1]|proc=P);
The detailed output is in the file tmp.output.*
The answer is in the variable Phc.
0
[234] Phc;
[[[-1.93185,0],[-0.517638,0]],
 [[0.517638,0],[1.93185,0]],
 [[-0.517638,0],[-1.93185,0]],
 [[1.93185,0],[0.517638,0]]]

[x=[real, imaginary], y=[real,imaginary]], the first solution
[x=[real, imaginary], y=[real,imaginary]], the second solution
...
```

#### Reference

ox\_launch, phc.start,  $\$(\text{OpenXM\_HOME})/\text{bin}/\text{lin\_phcv2}$ (original PHC pack binary for linux)

# Index

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