

## DOPTPRM Design Optimization Parameters

Overrides default values of parameters used in design optimization.

**Format:**

1	2	3	4	5	6	7	8	9	10
DOPTPRM	PARAM1	VAL1	PARAM2	VAL2	PARAM3	VAL3	PARAM4	VAL4	
	PARAM5	VAL5	-etc.-						

**Example:**

DOPTPRM	IPRINT	5	DESMAX	10					
---------	--------	---	--------	----	--	--	--	--	--

Field	Contents
PARAMi	Name of the design optimization parameter. Allowable names are given in Table 5-6. (Character)
VALi	Value of the parameter. (Real or Integer, see Table 5-6.)

**Remark:**

1. Only one DOPTPRM entry is allowed in the Bulk Data Section.

**Table 5-6 PARAMi Names and Descriptions**

Name	Description, Type, and Default Value
APRCOD	Approximation method to be used. 1 = Direct Linearization; 2=Mixed Method based on response type; 3 = Convex Linearization. APRCOD = 1 is recommended for shape optimization problems. (Integer 1, 2, or 3; Default = 2)
CONV1	Relative criterion to detect convergence. If the relative change in objective between two optimization cycles is less than CONV1, then optimization is terminated. (Real > 0.0; Default = 0.001)
CONV2	Absolute criterion to detect convergence. If the absolute change in objective between two optimization cycles is less than CONV2, then optimization is terminated. (Real > 0.0; Default = 1.0E-20)
CONVDV	Relative convergence criterion on design variables. (Real > 0.0; Default = 0.001)

**5**  
BULK

Foly  $1e^{-3}$

Foly  $1e^{-2}$

X  $1e^{-3}$

Table 5-6 PARAMi Names and Descriptions (continued)

Name	Description, Type, and Default Value
CONVPR	Relative convergence criterion on properties. (Real > 0.0; Default = 0.001)
CT	Constraint tolerance. Constraint is considered active if current value is greater than CT. (Real < 0.0; Default = -0.03)
CTMIN	Constraint is considered violated if current value is greater than CTMIN. (Real > 0.0; Default = 0.003)
DABOBJ	Maximum absolute change in objective between ITRMOP consecutive iterations (see ITRMOP) to indicate convergence at optimizer level. F0 is the initial objective function value. (Real > 0.0; Default = MAX[0.001*ABS(F0), 0.0001])
DELB	Relative finite difference move parameter. (Real > 0.0; Default = 0.0001)
DELOBJ	Maximum relative change in objective between ITRMOP consecutive iterations to indicate convergence at optimizer level. (Real > 0.0; Default = 0.001)
DELP	Fractional change allowed in each property during any optimization design cycle. This provides constraints on property moves. (Real > 0.0; Default = 0.2)
DELX	Fractional change allowed in each design variable during any optimization cycle. (Real > 0.0; Default = 1.0)
DESMAX	Maximum number of design cycles (not including FSD cycle) to be performed. (Integer $\geq$ 0; Default = 5)
DISCOD	Discrete Processing Method: (Integer 1, 2, 3 or 4; Default = 1) 1: Design of Experiments 2: Conservative Discrete Design 3: Rounding up to the nearest design variable 4: Rounded off to the nearest design variable
DISBEG	Design cycle ID for discrete variable processing initiation. Discrete variable processing analysis is carried out for every design cycle after DISBEG. (Integer $\geq$ 0, default = 0 = the last design cycle)

Table 5-6 PARAMi Names and Descriptions (continued)

Name	Description, Type, and Default Value
DOBJ1	Relative change in objective attempted on the first optimization iteration. Used to estimate initial move in the one-dimensional search. Updated as the optimization progresses. (Real > 0.0; Default = 0.1)
DOBJ2	Absolute change in objective attempted on the first optimization iteration. (Real > 0.0; Default = $0.2 \cdot (F_0)$ )
DPMIN	Minimum move limit imposed. (Real > 0.0; Default = 0.01)
DX1	Maximum relative change in a design variable attempted on the first optimization iteration. Used to estimate the initial move in the one dimensional search. Updated as the optimization progresses. (Real > 0.0; Default = 0.01)
DX2	Absolute change in a design variable attempted on the first optimization iteration. (Real > 0.0; Default = $0.2 \cdot \text{MAX}[X(I)]$ )
DXMIN	Minimum design variable move limit (Real > 0.0; Default = 0.05).
FSDALP	Relaxation parameter applied in Fully Stressed Design (Real, $0.0 < \text{FSDMAX} \leq 1.0$ , Default = 0.9)
FSDMAX	Specifies the number of Fully Stressed Design Cycles that are to be performed (Integer, Default = 0)
GMAX	Maximum constraint violation allowed at the converged optimum. (Real > 0.0; Default = 0.005)
GSCAL	Constraint normalization factor. See Remarks under the DSCREEN and DCONSTR entries. (Real > 0.0; Default = 0.001)
IGMAX	If IGMAX = 0, only gradients of active and violated constraints are calculated. If IGMAX > 0, up to NCOLA gradients are calculated including active, violated, and near active constraints. (Integer > 0; Default = 0)

5

BULK

df init  
ML  $1 \cdot 10^{-2}$   
Const  
Const  
calcd dc  
DC gaged  
act.



Table 5-6 PARAMi Names and Descriptions (continued)

Name	Description, Type, and Default Value
IPRINT	Print control during approximate optimization phase. Increasing values represent increasing levels of optimizer information. ( $0 \leq \text{Integer} \leq 7$ ; Default = 0) 0 no output (Default) 1 internal optimization parameters, initial information, and results 2 same, plus objective function and design variables at each iterations 3 same, plus constraint values and identification of critical constraints 4 same, plus gradients 5 same, plus search direction 6 same, plus scaling factors and miscellaneous search information 7 same, plus one dimensional search information
IPRNT1	If IPRNT1 = 1, print scaling factors for design variable vector. (Integer 0 or 1; Default = 0)
IPRNT2	If IPRNT2 = 1, print miscellaneous search information. If IPRNT2 = 2, turn on print during one-dimensional search process. (Warning: This may lead to excessive output.) (Integer 0, 1, or 2; Default = 0)
ISCAL	Design variables are rescaled every ISCAL iterations. Set ISCAL = -1 to turn off scaling. (Integer; Default=NDV (number of design variables))
ITMAX	Maximum number of iterations allowed at optimizer level during each design cycle. (Integer; Default = 40)
ITRMOP	Number of consecutive iterations for which convergence criteria must be satisfied to indicate convergence at the optimizer level. (Integer; Default = 2)
ITRMST	Number of consecutive iterations for which convergence criteria must be met at the optimizer level to indicate convergence in the Sequential Linear Programming Method. (Integer > 0; Default = 2)
IWRITE	FORTTRAN unit for print during approximate optimization phase. Default value for IWRITE is set to the FORTRAN unit for standard output. (Integer>0, Default=6 or value of SYSTEM(2).)

Table 5-6 PARAMI Names and Descriptions (continued)

Name	Description, Type, and Default Value
JTMAX	Maximum number of iterations allowed at the optimizer level for the Sequential Linear Programming Method. This is the number of linearized subproblems solved. (Integer $\geq 0$ ; Default = 20)
JPRINT	Sequential Linear Programming subproblem print. If JPRINT > 0, IPrint is turned on during the approximate linear subproblem. (Default = 0)
JWRITE	If JWRITE > 0, file number on which iteration history will be written. (Integer > 0; Default = 0)
METHOD	Optimization Method: (Integer 1, 2, or 3; Default = 1) 1: Modified Method of Feasible Directions. (Default) 2: Sequential Linear Programming 3: Sequential Quadratic Programming
P1	Print control items specified for P2. (Integer $\geq 0$ ; Default = 0) Initial results are always printed prior to the first approximate optimization. If an optimization task is performed, final results are always printed for the final analysis unless PARAM,SOFTEXIT,YES is specified. These two sets of print are not controllable. n: Print at every n-th design cycle.
P2	Items to be printed according to P1: (Integer; Default = 1) 0: No print. 1: Print objective and design variables. (Default) 2: Print properties. 4: Print constraints. 8: Print responses. 10: Print weight as a function of a material ID (note that this is not a design quantity so that only inputs to the approximate design are available). n: Sum of desired items. For example, P2 = 10 means print properties and responses.
PLVIOL	Flag for handling of property limit violation. By default, the job will terminate with a user fatal message if the property derived from design model (DVPRELi, DVMRELi, DVCRELi) exceeds the property limits. Setting PLVIOL to a non-zero number will cause the program to issue a user warning message by ignoring the property limits violation and proceed with the analysis. (Integer; Default=0)

Table 5-6 PARAMi Names and Descriptions (continued)

Name	Description, Type, and Default Value
PTOL	Maximum tolerance on differences allowed between the property values on property entries and the property values calculated from the design variable values on the DESVAR entry (through DVPRELi relations). PTOL is provided to trap ill-posed design models. (The minimum tolerance may be specified on user parameter DPEPS. See "Parameters" on page 1417) (Real > 0.0; Default = 1.0E+35)
STPSCL	Scaling factor for shape finite difference step sizes, to be applied to all shape design variables. (Real > 0.0; Default = 1.0)