Table 1: The whole configuration space of *MetaVC*.

Parameter	Depended Conditions	Parameter Type	Value Domain	Default Value
$performPreProcess$	–	Boolean-valued	{*True*, *False*}	*True*
$initConstruct$	–	Categorical	{1, 2}	1
$performReConstruct$	–	Boolean-valued	{*True*, *False*}	*False*
$prob\_rc$	$perfromReConstruct == True$	Real-valued	[0.00001, 0.05]	0.0001
t	$perfromReConstruct == True$	Integer-valued	[1, 100]	10
$performBMS$	–	Boolean-valued	{*True*, *False*}	*False*
bms_k	$performBMS == True$	Integer-valued	[10, 1000]	50
$pickRmVertex$	–	Categorical	{1, 2, 3}	1
$pickUncovEdge$	–	Categorical	{1, 2}	1
$pickAddVertex$	–	Categorical	{1, 2, 3}	1
$tabu\_tenure$	$pickAddVertex == 3$	Integer-valued	[1,5]	3
$performEdgeWeight$	–	Boolean-valued	{*True*, *False*}	*True*
$edgeWeight$	$performEdgeWeight == True$	Categorical	{1, 2}	1

Table 2: The default configuration of *MetaVC*.

Instantiation	Configuration Setting
Default	$performPreProcess = True$, $initConstruct$=1, $performReConstruct = False$, $prob\_rc$=0.0001, t=10, $performBMS = False$, $pickRmVertex$=1, $pickUncovEdge$=1, $pickAddVertex$=1, $performEdgeWeight = True$, $edgeWeight$=1

Table 3: The optimized configurations of *MetaVC* for all benchmarks.

Benchmark/Instance Family	Optimized Configuration
brock-HARD and *brock-EASY*	$performPreProcess = True$, $initConstruct$=2, $performReConstruct = True$, $prob\_rc$=0.0028421872317207584, t=100, $performBMS = False$, $pickRmVertex$=3, $pickUncovEdge$=2, $pickAddVertex$=1, $performEdgeWeight = True$, $edgeWeight$=2
DIMACS-HARD and *DIMACS-EASY*	$performPreProcess = False$, $initConstruct$=1, $performReConstruct = False$, $performBMS = False$, $pickRmVertex$=1, $pickUncovEdge$=2, $pickAddVertex$=1, $performEdgeWeight = True$, $edgeWeight$=1
BHOSLIB-HARD and *BHOSLIB-EASY*	$performPreProcess = True$, $initConstruct$=2, $performReConstruct = False$, $performBMS = False$, $pickRmVertex$=2, $pickUncovEdge$=1, $pickAddVertex$=3, $tabu\_tenure$=5, $performEdgeWeight = True$, $edgeWeight$=1
REAL-WORLD-HARD and *REAL-WORLD-EASY*	$performPreProcess = True$, $initConstruct$=2, $performReConstruct = True$, $prob\_rc$=3.908659583029911E-5, t=84, $performBMS = True$, bms_k=633, $pickRmVertex$=2, $pickUncovEdge$=1, $pickAddVertex$=2, $performEdgeWeight = False$

Table 4: The optimized configuration of *MetaVC2* for all benchmarks.

Benchmark/Instance Family	Optimized Configuration
brock-HARD and *brock-EASY*	$performPreProcess = False$, $initConstruct$=2, $performReConstruct = True$, $prob\_rc$=0.010648810472426678, t=100, $performBMS = False$, $pickRmVertex$=3, $pickUncovEdge$=2, $pickAddVertex$=1, $performEdgeWeight = True$, $edgeWeight$=2
DIMACS-HARD and *DIMACS-EASY*	$performPreProcess = True$, $initConstruct$=1, $performReConstruct = False$, $performBMS = False$, $pickRmVertex$=1, $pickUncovEdge$=2, $pickAddVertex$=1, $performEdgeWeight = True$, $edgeWeight$=1
BHOSLIB-HARD and *BHOSLIB-EASY*	$performPreProcess = True$, $initConstruct$=1, $performReConstruct = False$, $performBMS = False$, $pickRmVertex$=2, $pickUncovEdge$=1, $pickAddVertex$=1, $performEdgeWeight = True$, $edgeWeight$=1
REAL-WORLD-HARD and *REAL-WORLD-EASY*	$performPreProcess = True$, $initConstruct$=2, $performReConstruct = True$, $prob\_rc$=3.0886947578801404E-5, t=76, $performBMS = True$, bms_k=720, $pickRmVertex$=1, $pickUncovEdge$=1, $pickAddVertex$=2, $performEdgeWeight = False$