Revision 2.X 11/06/2022 – added various routines

This documents which Java/C++ WPILIB routines have been duplicated in LabVIEW, and which ones are not needed (for example because all that is needed is a cluster unpack function), and what isn't done....yet...

VI / CTL Totals
VI Total (X)
CTL Totals
CTL Total (Z)
VI Shell Total (I)
CTRL Shell Total (I)

Doc completed Pct 99.26% Optimization Pct 55.93%

Optimize legend: S = Subroutine, I = Inline, X = reviewed, nothing done. (In some cases, after sufficient debug and use, additional optimizations could be considered.)

'===== BASE

BASE '=======

ANALOG DELAY	X Implemented X Documented		X Menu Item	- Execution Optimized		Function Prototype	Notes Similar to interpolated tree map	Code Review	Test Program	Error Checking
BUMPLESS TRANSFER	X Implemented Documented	X Not WPILIB	X Menu Item	Execution Optimized	VI Name BumplessTransfer_Execute.vi	Function Prototype	Notes Similar to interpolated tree map	Code Review	Test Program	Error Checking
FUNCTION GENERATOR	X X Implemented X X Documented		X X Menu Item	Execution Optimized	VI Name FunctionGenerator_Add_Value.vi FunctionGenerator_Add_XY.vi	Function Prototype	Notes Similar to interpolated tree map Similar to interpolated tree map	Code Review	Test Program	Error Checking
	X	X	X	I SI I SI	FunctionGenerator_Calculate.vi FunctionGenerator_Clear.vi FunctionGenerator_Execute.vi FunctionGenerator_New.vi		Similar to interpolated tree map Similar to interpolated tree map Similar to interpolated tree map			
	Implemented Documented		Menu Item	Execution Optimized	VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
FUNCTION GENERATOR MATRIX	X X X	X	X		FunctionGeneratoMatrixr_Add.vi FunctionGenerator_Calculate.vi		Similar to interpolated tree map Similar to interpolated tree map			

FRC_LabVIEW_Trajectory_Library_Routines.xlsx

ous routines							
	X X X X SI	FunctionGenerator_New.vi		Similar to interpolated tree map			
LEAD LAG		VI Name LeadLag Execute.vi	Function Prototype	Notes Similar to interpolated tree map	Code Review	Test Program	Error Checking
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LINEAR FILTEI		We will be set to the set of the	Function Prototype	Notes	Code Review	Test Program	Error Checking
	X X X SI	LinearFilter_Calculate.vi					
	X X X X X X X X X X X X X X X X X X X	LinearFilter_CutoffFrequency.vi X LinearFilter_Execute.vi LinearFilter_Factorial.vi LinearFilter_FiniteDifference.vi LinearFilter_HighPass.vi		Labview style helper AN INTERNAL ROUTINE			
	X X X X X	LinearFilter_HighPassBW1.vi					
	X X X X X	LinearFilter_HighPassBW2.vi					
		LinearFilter_LowPassBW1.vi					
	X X X X X	LinearFilter_LowPassBW2.vi					
	X X X X	LinearFilter_MovingAverage.vi					
	X X X I X X X SI	LinearFilter_New.vi LinearFilter Reset.vi					
	X X X SI	LinearFilter_Reset.vi LinearFilter ResetToValue.vi					
		LinearFilter_Reset i ovalue.vi LinearFilter_SinglePoleIIR.vi					
	X X X X X X X X X X	LinearFilter TimeConst.vi					
MEDIAN FILTEI		WedianFilter_ResetToValue.vi	Function Prototype	Notes Labview style helper	Code Review	Test Program	Error Checking
SLEW RATE FILTE		VI Name SlewRateLimiter_Calculate.vi SlewRateLimiter_Close.vi X SlewRateLimiter_Execute.vi SlewRateLimiter_GetRate.vi SlewRateLimiter_New.vi SlewRateLimiter_NewInitialZero.vi SlewRateLimiter_Reset.vi SlewRateLimiter_Reset.vi SlewRateLimiter_SetRate.vi	Function Prototype	Notes Labview style helper	Code Review	Test Program	Error Checking

022 – added various routines												
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TIMER	X		X	X			Timer_Close.vi		releases semaphore			
	X	Χ		X			X Timer_Get.vi					
	Χ		X	X			Timer_GetAndReset.vi			ļ!		
	X	X	X				Timer_GetInternal.vi		Internal (private) only	<u> </u>		
	X	X		X			X Timer_HasPeriodPassed.vi			!		
	X		X				X Timer_HasPeriodPassedOnce.vi			<u> </u>		
	X	X	+	X			X Timer_New.vi					
	X	X	X	X No			X Timer_Reset.vi Timer ResetInternal		Internal (private) only			
	X	X		X		_	X Timer_Start.vi		internal (private) only			
	X	X		$\frac{\lambda}{X}$			X Timer_Stop.vi					
	\overline{X}	X	X				Timer_StopInternal.vi		Internal (private) only			
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TIME INTERPOLATABLE BOOLEAN		X	X	X	1		TimeInterpBoolean_AddSample.vi		Update to use create matrix			
	X	X	X	No	1		TimeInterpBoolean_CleanUp.vi		Update to use create matrix			
	X			X	S	1	TimeInterpBoolean_Clear.vi			<u> </u>		
	X	X	X	X	1		TimeInterpBoolean_GetSample.vi			<u> </u>		
	X	X	X	$\frac{X}{X}$	S		TimeInterpBoolean_New.vi TimeInterpBoolean_SetMaxTime.vi			<u> </u>		
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					Execution Optimized	ĺ	2					
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TIME INTERPOLATABLE DOUBLE	X			\overline{X}			TimeInterpDouble_AddSample.vi	- amount recoype	Update to use create matrix			7
	X		X	No			TimeInterpDouble_CleanUp.vi		Update to use create matrix			
	Χ	X	X	X	S	ı	TimeInterpDouble_Clear.vi		·	1		
	Χ	Χ	X	X	1		TimeInterpDouble_GetSample.vi					
	X	X	X	X	S	1	TimeInterpDouble_New.vi			<u> </u>		
	X	X	X	X	S	<i>I</i>	TimeInterpDouble_SetMaxTime.vi			<u></u> '		
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TIME INTERPOLATABLE POSE2D	X		<u>≥</u>				7) VI Name TimeInterpPose2d_AddSample.vi	i unction Frototype	Update to use create matrix			
TIME INTERN CLATABLE FOSEZO	X			No	1		TimeInterpPose2d_Addoannpie.vi TimeInterpPose2d_CleanUp.vi		Update to use create matrix			
	X		X	X	S	,	TimeInterprose2d_Clear.vi		opado to doo orodio matrix			
	X			$\frac{1}{X}$	1		TimeInterpPose2d_GetSample.vi					
	Χ	Χ	Χ	X	S	I	TimeInterpPose2d_New.vi					
	X	X	X	X	S	1	TimeInterpPose2d_SetMaxTime.vi					

FRC LabVIEW Trajectory Library - VI Implementation List Revision 2.X 11/06/2022 – added various routines Function Prototype TIME INTERPOLATABLE ROTATION2D $\begin{array}{c|cccc} \hline X & X \\ \hline \end{array}$ TimeInterpRotation2d AddSample.vi Update to use create matrix Χ X No TimeInterpRotation2d_CleanUp.vi Update to use create matrix X X SI TimeInterpRotation2d_Clear.vi X X X X I TimeInterpRotation2d_GetSample.vi TimeInterpRotation2d_New.vi
TimeInterpRotation2d_SetMaxTime.vi X X X X SI X X X X SI Function Prototype VI Name Notes WAIT ADJUST X WaitAdjust.vi Function Prototype Notes DIGITAL SEQUENTIAL LOGIC X DigSeqLogic_Delay.vi X X XX DigSeqLogic_On_Delay.vi DigSeqLogic_Off_Delay.vi DigSeqLogic_One_Shot.vi
DigSeqLogic_SR_Flip_Flop.vi Function Prototype Notes DEBOUNCER $\begin{array}{c|c} X & X \\ \hline X & X \end{array}$ X Debouncer New.vi Debouncer Calculate.vi X X X X Debouncer Execute.vi

'========
CONTROLLER
'

ARM FF X X X X X A X A ArmFF_Calculate.vi LabVIEW style single call

XX

XX

No

No

Debouncer_Reset.vi
Debouncer HasElapsed.vi

ous routines												
			X				ArmFF_ExecuteVelocityOnly.vi		LabVIEW style single call			
	X			X			ArmFF_MaxAchieveAccel.vi					
	Χ			X			ArmFF_MaxAchieveVelocity.vi					
	Χ	X		X			ArmFF_MinAchieveAccel.vi					
	Χ	X		X			ArmFF_MinAchieveVelocity.vi					
	Χ	X		X			ArmFF_New_ZeroGravity.vi					
	Χ	X		X			ArmFF_New.vi					
BANG BANG	X X X X X X	X X X X		X X X X X X X X X X X X X X X X X X X	19 19 19 19 19 19 19 19	DESTRUCTION OF THE PROPERTY OF	VI Name BangBang_AtSetpoint.vi BangBang_Calculate_PV.vi BangBang_Calculate_SP_PV.vi BangBang_Execute.vi BangBang_GetAll.vi BangBang_GetError.vi BangBang_New.vi BangBang_SetSetpoint.vi	Function Prototype	Notes	Code Review	Test Program	Error Checking
	Χ	X		X	SI		BangBang_SetTolerance.vi					
CONTROLLER UTIL	X Implemented	X Documented	Not WPILIB	X Menu Item	© Execution Optimized		VI Name ControllerUtil_GetModulusError.vi	Function Prototype	Notes This was short lived in WPILIB, but still useful here.	Code Review	Test Program	Error Checking
	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	פאן אסמוווש	Sample Program	Function Prototype	Notes	Code Review	Test Program	Error Checking
ELEV FF	_ <u>=</u> _	X	_ <	X	<u> </u>	` 	ElevFF_Calculate.vi	r unction Frototype	Notes			Щ
	X	X		$\frac{x}{x}$			ElevFF CalculateVelocityOnly.vi					
			X	+ ^ +		+	ElevFF_Execute.vi		LabVIEW style single call			
			X	+ +		+	ElevFF_ExecuteVelocityOnly.vi		LabVIEW style single call			
	Χ	X		X			ElevFF MaxAchieveAccel.vi					
	X	X		X			ElevFF MaxAchieveVelocity.vi					
	X	X		X			ElevFF_MinAchieveAccel.vi					
	Χ	X		X			ElevFF_MinAchieveVelocity.vi					
	X	X		X			ElevFF_New_ZeroAccel.vi					
	X	X		X	timized		ElevFF_New.vi					б
	Implemented	Documented	Not WPILIB	Menu Item	Execution Opt	ן פאן אסמווויפ	Sample Program	Function Prototype	Notes	Code Review	Test Program	Error Checking
HOL_DRV_CTRL				X			HolDrvCtrl_AdvCalculate_Trajectory.vi		Added 1/24/2022			
	X	X	X	X			HolDrvCtrl_AdvCalculate.vi		Added 1/24/2022			
	X	X		X	SI		HolDrvCtrl_AtReference.vi		Added 1/26/21			
	X X X	Χ		X X X	1		HolDrvCtrl_Calculate_Trajectory.vi HolDrvCtrl_Calculate.vi HolDrvCtrl_Execute_Trajectory.vi		Added 1/26/21 Added 1/26/21 Added 1/24/2022			
Ļ	^	_ ^	_ ^	_ ^			TOID TYOUI_EXECUTE_TTAJECTORY.VI		7412022			

routines													
	X	X	X	X				HolDrvCtrl Execute.vi		Future			
	X	Χ		X	SI			HolDrvCtrl New.vi		Added 1/26/21			
			~		SI			HolDrvCtrl PackExecuteSP.vi		714454 1/20/21			
	X	X	X	X	اد					1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			
	X	X	Χ	X				HolDrvCtrl_PackPID.vi		Added 1/24/2022			
	X	Χ	Χ	X				HolDrvCtrl PackProfPID.vi		Added 1/24/2022			
	X	X		X	SI			HolDrvCtrl SetEnabled.vi		Added 1/26/21			
	X	X		X	SI			HolDrvCtrl_SetTolerance.vi		Added 1/26/21			
PID AUTOTUNE	X Implemented	Documented	X Not WPILIB	S Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name PIDAutoTune_ClosedLoopStep.vi	Function Prototype	Notes	Code Review	Test Program	Error Checking
	X		Χ					PIDAutoTune_Convert_Academic_To_NonInteracting.vi					
	х		Χ					PIDAutoTune_OpenLoopStep.vi					
			X					PIDAutoTune_SetTuningArguments.vi					
	X		Λ 	X									
	X		Χ	X				PIDAutoTune_Step.vi					
	mplemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
DID CONTROL I ED				<u> </u>	Щ.	_	0)		1 difficition i fototype				<u> </u>
PID CONTROLLER		Χ	X	X				PIDController_AdvCalculate_FF_Sp_Pv_Per.vi		Advanced PID			
	X	X	X	X				PIDController_AdvCalculate_FF_Sp_Pv.vi		Advanced PID			
	X	X	X	X			X	PIDController_AdvExecute.vi		Labview style helper. Advanced			
								· –		PID '			
	X	X		X	SI			PIDController AtSetpoint.vi					
					31								
	X	Χ		X				PIDController_Calculate_PV.vi					
	X	X		X				PIDController Calculate SP PV.vi					
	X	X		X	SI			PIDController DisableContinousInput.vi					
	X	X		X	SI			PIDController_EnableContinousInput.vi					
	X	X	X	X			X	PIDController Execute.vi		Labview style helper			
								PIDController GetContinuousError.vi		OBSOLETE – Removed			
	Χ	~		V	SI			PIDController GetPeriod.vi		02002212 1101110100			
		X		X									
	X	X		X	SI			PIDController_GetPID.vi					
	X	X		X	SI			PIDController GetPositionError.vi					
	X	X		X	SI			PIDController GetSetpoint.vi					
	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \			\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	0/								
		X		X	SI			PIDController_GetVelocityError.vi					
	X	X		X	SI			PIDController_IsContinuousInputEnabled.vi					
	Χ	X		X	1			PIDController New.vi					
	X	X		X	i			PIDController NewPeriod.vi					
			V										
	X		X	X	SI			PIDController_Pack_AdvLimits.vi					
	X	X	X	X	SI			PIDController_Pack_AdvTuning.vi					
	X	Χ		X	SI			PIDController Pack ErrorTolerance.vi					
	X	X		X	SI			PIDController Pack InputLimits.vi					
						\vdash		DIDO ortalia Daria Taria ani					
	X	Χ	Χ	X	SI			PIDController_Pack_Tuning.vi					
	X	X		X	SI			PIDController_Reset.vi					
	X	X		X	SI			PIDController SetD.vi					
	X	X	~		SI			PIDController SetDerivativeFilter.vi		Advanced PID			
					ા								
	X	X	X	No				PIDController_SetFeedForward_OBSOLETE_DELETE.vi		Advanced PID, Obsolete – DELETE			
	X	X	X	No				PIDController_SetFFGain_OBSOLETE_DELETE.vi		Advanced PID, Obsolete – DELETE			
	X	Χ		X	SI			PIDController_Setl.vi					
								PIDController SetInputRange.vi		OBSOLETE - Removed			
	Х	Χ		Х	SI			PIDController_SetIntegratorRange.vi	<u> </u>				
						\vdash				100			
	Χ		X		SI			PIDController_SetOutputLimits.vi		Advanced PID			
	X	Χ		X	SI			PIDController_SetP.vi					
		X	X	X	SI			PIDController SetPeriod.vi					
			<u> </u>			\vdash		PIDController_SetPID.vi					
	X	X		X	SI	\vdash							
	X	Χ	X	X	SI			PIDController_SetPIDF.vi		Advanced PID			

XX	X S		PIDController_SetSetpoint.vi
XX	X S	31	PIDController_SetTolerance.vi
XX	X S	3/	PIDController_SetTolerancePandV.vi

					<u> </u>		i ib controllor_corrollorarioc.vi					
	X	X		Χ	SI		PIDController_SetTolerancePandV.vi					
PROFILED PID CONTROLLER	Implemented	Ø	Not WPILIB	X Menu Item	ত Execution Optimized থ	Test Routine	FIDCONTIONEL_SetTolerancePandV.VI	Function Prototype	Notes	Code Review	Test Program	Error Checking
	X	X		X	SI		ProfiledPIDController_AtSetpoint.vi					
	X	X		X	<u> </u>		ProfiledPIDController Calculate Meas Goal.vi					
	X	X		X			ProfiledPIDController Calculate Meas StateGoal TrapCnsrt.vi					
	X	X		Χ			ProfiledPIDController Calculate Meas StateGoal.vi					
	X	X		X			ProfiledPIDController Calculate Meas.vi					
	X	X		X	SI		ProfiledPIDController DisableContInput.vi					
	X	X		X	SI		ProfiledPIDController EnableContInput.vi				ĺ	
	X		X	Χ	1		ProfiledPIDController_Execute.vi		Single call LabVIEW style function.			
	Χ			Χ	SI		ProfiledPIDController_GetGoal.vi					
	Χ	X		Χ	SI		ProfiledPIDController_GetPeriod.vi					·
	Χ		X	Χ	SI		ProfiledPIDController_GetPID.vi		WPILIB has separate getters.			
	X	X		Χ	SI		ProfiledPIDController_GetPositionError.vi					
	Χ	X		Χ	SI		ProfiledPIDController_GetSetpoint.vi					
	Χ	X		Χ	SI		ProfiledPIDController_GetVelocityError.vi					
	Χ	X		Χ	1		ProfiledPIDController_New.vi					
	X	X		Χ	1		ProfiledPIDController_NewPeriod.vi					
	X	X		Χ	SI		ProfiledPIDController_Reset_PosOnly.vi					
	X	X		Χ	SI		ProfiledPIDController_Reset_PosVel.vi					
	X	X		Χ	SI		ProfiledPIDController_Reset.vi					1
	Χ	X		Χ	SI		ProfiledPIDController_SetConstraints.vi					-
	X	X		Χ	SI		ProfiledPIDController_SetGoal_PosOnly.vi					
	Χ	X		Χ	SI		ProfiledPIDController_SetGoal.vi					
	X	X		Χ	SI		ProfiledPIDController_SetIntegratorRange.vi					
	Χ	X		Χ	SI		ProfiledPIDController_SetPID.vi					
_	Χ	Χ		Χ	SI		ProfiledPIDController_SetTolerance_PosOnly.vi					
	Χ	X		Χ	SI		ProfiledPIDController_SetTolerance_PosVel.vi				1	

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimize	Test Routine	Sample Program	VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
RAMSETE	Χ	X		X	SI			Ramsete_AtReference.vi	AtReference				
	Χ	X		X	Χ			Ramsete_Calculate_Trajectory.vi	calculate_trajectory				
	Χ	X		X	Χ			Ramsete_Calculate.vi	calculate				
	Χ	X	Χ	X	Χ			Ramsete_Diff_DO_Eng.vi					
	Χ	X	Χ	Χ	Χ			Ramsete_Diff_DO_SI.vi					
	Χ	X	Χ	Χ	- 1			Ramsete_Execute_ENG.vi	Use this one!!				
	Χ	X	Χ	Χ	SI			Ramsete_Execute_PackTuning_ENG.vi					
	Χ	X	Χ	Χ	SI			Ramsete_Execute_PackTuning.vi					
	Χ	X	Χ	Χ	1			Ramsete_Execute.vi					
	Χ	X		Χ	SI			Ramsete_New_B_Z.vi	new(b, zeta)				
	Χ	X		Χ	SI			Ramsete_New.vi	new				
	Χ	X		Χ	SI			Ramsete_SetEnabled.vi	SetEnabled				
	Χ	X		Χ	SI			Ramsete_SetTolerance.vi	SetTolerance				
	Χ	X		X	Χ			Ramsete SINC.vi	sinc	internal			

FRC LabVIEW Trajectory Library – VI Implementation List Revision 2.X 11/06/2022 – added various routines Execution Optimized Routine Not WPILIB Menu Item Function Prototype Notes SIMPLE MOTOR FEEDFORWARD $X \mid X$ SimpleMotorFF Calculate CalcAccel.vi X SimpleMotorFF Calculate NextV Dt.vi Χ X X X X SI SimpleMotorFF Calculate.vi public double calculate(double velocity, double acceleration) SimpleMotorFF_CalculateVelocityOnly.vi X X X SI public double calculate(double velocity) X X Χ SimpleMotorFF MaxAchieveAccel.vi public double maxAchievableAcceleration(double maxVoltage, double velocity) Χ X Χ SimpleMotorFF MaxAchieveVel.vi public double maxAchievableVelocity(double maxVoltage, double X X X SimpleMotorFF MinAchieveAccel.vi public double minAchievableAcceleration(double maxVoltage, double velocity) Χ Χ SimpleMotorFF_MinAchieveVel.vi X public double minAchievableVelocity(double maxVoltage, double acceleration)
public SimpleMotorFeedforward(double ks, double kv, double ka) SimpleMotorFF New.vi Χ SI X public SimpleMotorFeedforward(double ks, double kv) '======== **GEOMETRY** '======== Routine VI Name Function Prototype Notes COORDINATE AXIS X CoordAxis D.vi X X SI SI CoordAxis_E.vi Χ Χ X X X SI CoordAxis N.vi X Χ SI CoordAxis New.vi Χ X SI X CoordAxis S.vi Χ Χ X SI CoordAxis U.vi XX X SI CoordAxis W.vi Function Prototype Notes COORDINATE SYSTEM XX Χ SI CoordSystem Convert Pose3d.vi CoordSystem Convert Rotation3d.vi XX X SI XX X SI CoordSystem_Convert_Translation3d.vi X SI CoordSystem_Convert_Transform3d.vi X X Χ SI X CoordSystem_EDN.vi Χ Χ X SI X CoordSystem_NED.vi X X Χ X SI X CoordSystem New.vi X SI X CoordSystem NWU.vi X Execution Optir Function Prototype Notes

boolean equals(other obj)

rotation2d getRotation()

pose2d exp(twist2d twist)

POSE2D

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X SI

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X SI

Pose2d_Equals.VI

Pose2d getRotation.vi

Pose2d Exp.vi

can also use cluster unpack

implementation i	LISI								_				
outines				T				D 01 17 111 1		· · · · · · · · · · · · · · · · · · ·			
	X	X		X	SI			Pose2d_getTranslation.vi	translation2d getTranslation()	can also use cluster unpack			
	X	X	X	X	SI			Pose2d_getXY.vi					
	X	X	X		SI			Pose2d_getXYAngle.vi					
	X	X		X	I			Pose2d_Interpolate.vi					
	Χ	X		X	X			Pose2d_Log.vi	twist2d log(pose2d end)				
	X	Χ		X	SI			Pose2d_Minus.vi	transform2d minus(pose2d other)				
	X	X		X	SI			Pose2d_New_TRRO.vi	pose2d new(translation2d, rotation2d)				
	X	X		X	SI			Pose2d_New.vi	pose2d new(double x, double y, rotation2d)				
	X	X		X	SI			Pose2d_Plus.vi	pose2d plus(transform2d other)				
	X	X		X	SI			Pose2d_RelativeTo.vi	pose2d relativeto(pose2d other)				
	Χ	X		X	SI			Pose2d_TransformBy.vi	pose2d transformby(transform2d other)				
									pose2d new()	can use cluster constant			
	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
POSE3D	X	X		X		T .	_ <u>, </u>	Pose3d Equals.VI					7
1 OOLOD	X	X		$\frac{\lambda}{X}$	X			Pose3d_Exp.vi					
	X	X		$\frac{\lambda}{X}$	SI			Pose3d_getRotation.vi					
	X	X		X				Pose3d_getTranslation.vi					
			V										
	X	X	X	X	SI			Pose3d_getXYZ.vi					
	X			X	1			Pose3d_Interpolate.vi					
	X	X		X	X			Pose3d_Log.vi					
	X	X		X	SI			Pose3d_Minus.vi					
	X	X		X	SI			Pose3d_New.vi					
	X	X		X	SI			Pose3d_New_Default.vi					
	X	X		X	SI			Pose3d_New_Trans3dRot3d.vi					
	X	X		X	SI			Pose3d_Plus.vi					
	Χ	Χ		X	SI			Pose3d RelativeTo.vi					
	X	Χ		No	SI			Pose3d RotationVectorToMatrix.vi					
	X	Χ		X	SI			Pose3d ToPose2d.vi					
	X	Χ		X				Pose3d_TransformBy.vi					
								, <u> </u>					
QUATERNION	X Implemented	X Documented	Not WPILIB	X Menu Item	ত Execution Optimized	Test Routine	Sample Program	VI Name Quaternion_Equals.vi	Function Prototype	Notes	Code Review	Test Program	Error Checking
QUATERNIUN			1					Quaternion_Equals.vi Quaternion Get All.vi					
	X	X	-	X	SI			Quaternion Get LVQuat.vi					
			1	X		1							
	X	X		X	SI			Quaternion_Get_Vect.vi					
	X	X		X	SI			Quaternion_Get_W.vi					
	X	X		X	SI			Quaternion_Inverse.vi					
	X	X	1	X	SI			Quaternion_New.vi					
	X	X	1	X	SI			Quaternion_New_Default.vi					
	X	X		X	SI			Quaternion_New_LVQuat.vi					
	X	X		X	SI			Quaternion_Normalize.vi					
	X	X		X	SI			Quaternion_Plus.vi					
	X	X		X	SI			Quaternion_Times.vi					
	X	Χ		X	SI			Quaternion_ToRotationVector.vi					
'		_	_		_								

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routines									_				
ROTATION2D	< X Implemented	X X Documented	Not WPILIB	X X Menu Item	일 일 Execution Optimized	Test Routine	Sample Program	VI Name Rotation2d_CreateAngle.vi Rotation2d_CreateAngleDegrees.vi	Function Prototype rotation2d new(double value) rotation2d fromDegrees(double degrees)	Notes	Code Review	Test Program	Error Checking
	X	X		X	SI			Rotation2d_CreateAngleDegrees.vi Rotation2d_CreateAngleRotations.vi	rotation2d fromDegrees(double degrees)	convert to radians then create			
	X	X		X	SI			Rotation2d CreateXY.vi	rotation2d new(double x, double y)				
	Χ	Χ		Χ	SI			Rotation2d_Equals.vi	boolean equals(rotation2d other)				
	X	Χ	Χ	X	SI			Rotation2d_GetAngleCosSin.vi		New 1/26/21			
	X	X		X	SI SI			Rotation2d_GetCos.VI Rotation2d_GetDegrees.VI	double getCos() double getDegrees()	use cluster unpack use cluster unpack, then convert to			
	^	^		^	SI			Rotation2d_GetDegrees.vi	double getDegrees()	degree			
	Χ	Χ		Χ	SI			Rotation2d_GetRadians.VI	double getRadians()	use cluster unpack			
	X	X		X	SI SI			Rotation2d_GetRotations.vi Rotation2d GetSin.VI	double getSin()	use cluster unpack			
	X	X		X	SI			Rotation2d_GetSin.VI Rotation2d_GetTan.VI	double getSin() double getTan()	can calculate			
	X	X		X	SI			Rotation2d_Interpolate.vi	assati gen an ()	Sur Sursurus			
	Χ	Χ		Χ	SI			Rotation2d_Minus.vi	rotation2d minus(rotation2d other)				
	X	X		X	SI			Rotation2d_Plus.vi	rotation2d plus(rotation2d other)				
	X	X		X	SI SI			Rotation2d_RotateBy.vi Rotation2d_Times.vi	rotation2d rotateby(rotation2d other) rotation2d times(double scalar)				
	X	X		X	SI			Rotation2d_UnaryMinus.vi	rotation2d unaryminus()				
									rotation2d new()	can use cluster constant			
ROTATION3D	X	X X X X X X X X X X X X X X X X X X X	X Not WPILIB	Wenu Items		Test Routine	Sample Program	VI Name Rotation3d_ Create_ AxisAngle.vi Rotation3d_ Create_ Default.vi Rotation3d_ Create_ Quaternion.vi Rotation3d_ Create_ InitialFinalVector.vi Rotation3d_ Create_ RollPitchYaw.vi Rotation3d_ Create_ RotMatrix.vi Rotation3d_ Equals.vi Rotation3d_ GetAxisAngle.vi Rotation3d_ GetQuaternion.vi Rotation3d_ GetXYZ.vi Rotation3d_ Interpolate.vi Rotation3d_ Minus.vi Rotation3d_ Plus.vi Rotation3d_ RotateBy.vi Rotation3d_ ToRotation2d.vi Rotation3d_ UnaryMinus.vi	Function Prototype	Notes	Code Reviev	Test Progra	Error Checking
	ted	pə,	9		Optimized	ine	rogram				iew	ram	cking
TRANSFORM2D	Χ	X X Documented	Not WPILIB	X X Menu Item	ଦ୍ର ଦ୍ର Execution	Test Routine	Sample Program	Transform2d_Create_PosePose.vi Transform2d_Create_TransRot.vi	Function Prototype transform2d new(pose2d, pose2d) transform2d new(translation2d, rotation2d)	Notes	Code Review	Test Program	Error Checking
TRANSFORM2D	X X X	X X X	Not WPILIB	X X X	ଦ୍ର ଦ୍ର Execution	Test Routine	Sample Program	Transform2d_Create_PosePose.vi Transform2d_Create_TransRot.vi Transform2d_Equals.VI	transform2d new(pose2d, pose2d) transform2d new(translation2d, rotation2d) boolean equals(other transform2d)		Code Review	Test Program	Error Checking
TRANSFORM2D	X	X	Not WPILIB	X X	ଦ୍ର ଦ୍ର Execution	Test Routine	Sample Program	Transform2d_Create_PosePose.vi Transform2d_Create_TransRot.vi	transform2d new(pose2d, pose2d) transform2d new(translation2d, rotation2d)	Notes use cluster unpack use cluster unpack	Code Review	Test Program	Error Checking

is routines													
	X	Χ	Χ	Χ	SI			Transform2d_GetXY.vi					
	X	Χ	Χ	Χ	SI			Transform2d_GetXYAngle.vi					
	X	Χ		Χ	SI			Transform2d_Inverse.vi	transform inverse()	new			
	X	Χ		Χ	Si			Transform2d_Plus.vi					
	X	Χ		Χ	SI			Transform2d_Times.vi	transform2d times(double scalar)				
									transform2d new()	can use cluster constant			
												·	
TRANSFORM3D	X Implemented	X Documented	Not WPILIB	X Menu Item	ত Execution Optimized	Test Routine		VI Name Transform3d_Create_Default.vi	Function Prototype	Notes	Code Review	Test Program	Error Checking
	X	Χ		Χ	SI			Transform3d_Create_Pose3dPose.3dvi					
	X	Χ		Χ	SI			Transform3d Create Trans3dRot3d.vi					
	X	Χ		X	SI			Transform3d Equals.VI					
	X	Χ		Χ	SI			Transform3d GetRotation3d.VI					
	X	Χ		Χ	SI			Transform3d GetTranslation3d.VI					
	X	Χ	X	X	SI			Transform3d GetXYZ.vi					
	X	X		X				Transform3d Inverse.vi					
	X	X		X	Si			Transform3d Plus.vi					
	X	X		X	SI			Transform3d Times.vi					
	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine		VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
TRANSLATION2D	<i>X</i>	Χ		Χ	SI			Translation2d_Create_DistAng.vi					
	X	Χ		Χ	SI			Translation2d_Create.vi	translation2d new(double x, double y)				
	X	Χ		Χ	SI			Translation2d_Equals.vi	boolean equals(translation other)				
	X	Χ		Χ	SI			Translation2d_GetAngle.vi					
	X	Χ		Χ	SI			Translation2d GetDistance.vi	double getDistance(translation2d other)				
	X	Χ		Χ	SI			Translation2d GetNorm.VI	double getNorm()	can use cluster unpack			
	X	Χ		Χ	SI			Translation2d GetX.VI	double getX()	can use cluster unpack			
	X	Χ	Χ	Χ	SI			Translation2d GetXY.VI	S (/	·			
	X	Χ		Х	SI			Translation2d GetY.VI	double getY()	can use cluster unpack			
	X	X		X	SI			Translation2d Interpolate.vi	January 3-11 ()				
	X			X				Translation2d_Minus.vi	translation2d minus(translation2d other)				
	X	X		X	SI			Translation2d Plus.vi	translation2d plus(translation2d other)				
	X			X				Translation2d_RotateBy.vi	translation2d rotateBy(rotation2d other)				
	X	X		X	SI			Translation2d Times.vi	translation2d times(double scalar)				
	X	X		X	SI.			Translation2d UnaryMinus.vi	translation2d unaryminus()				
	,			,,				- Carloidae - Lag-orial y minasin	translation2d new()	can use cluster constant			
									translation2d div(double scalar)	can multiply by 1/scalar			
					Optimized		ат					E	ecking
	lemented	cumented	WPILIB	nu Item	cution Op	t Routine	nple Progra				de Reviev	st Progran	or Che
	mplemented	Oocumented	Vot WPILIB	Vlenu Item	Execution Op	Test Routine	Sample Progra	VI Name	Function Prototype	Notes	Sode Reviev	Test Progra	Error Che
TRANSI ATIONAD	× Implemented	X Documented	Not WPILIB	× Menu Item	Execution	Test Routine		VI Name	Function Prototype	Notes	Code Review	Test Progra	Error Checking
TRANSLATION3D	X	Χ	Not WPILIB	X	© Execution	Test Routine		Translation3d_Create.vi	Function Prototype	Notes	Code Reviev	Test Progra	Error Che
TRANSLATION3D	X	X	Not WPILIB	X	S S Execution	Test Routine	-	Translation3d_Create.vi Translation3d_Create_Default.vi	Function Prototype	Notes	Code Reviev	Test Progra	Error Che
TRANSLATION3D	X X X	X X X	Not WPILIB	X X X	S S Execution	Test Routine		Translation3d_Create.vi Translation3d_Create_Default.vi Translation3d_Create_DistAng.vi	Function Prototype	Notes	Code Reviev	Test Progra	Error Ch
TRANSLATION3D	X X X X	X X X	Not WPILIB	X X X	S S Execution	Test Routine		Translation3d_Create.vi Translation3d_Create_Default.vi Translation3d_Create_DistAng.vi Translation3d_Div.vi	Function Prototype	Notes	Code Reviev	Test Progra	Error Ch
TRANSLATION3D	X X X X	X X X X	Not WPILIB	X X X X	S S Execution	Test Routine		Translation3d_Create.vi Translation3d_Create_Default.vi Translation3d_Create_DistAng.vi Translation3d_Div.vi Translation3d_Equals.vi	Function Prototype	Notes	Code Reviev	Test Progra	Error Ch
TRANSLATION3D	X X X X X	X X X X X	Not WPILIB	X X X X X	IS IS Execution	Test Routine		Translation3d_Create.vi Translation3d_Create_Default.vi Translation3d_Create_DistAng.vi Translation3d_Div.vi Translation3d_Equals.vi Translation3d_GetDistance.vi	Function Prototype	Notes	Code Reviev	Test Progra	Error Ch
TRANSLATION3D	X X X X	X X X X X X		X X X X X X	IS IS Execution	Test Routine		Translation3d_Create.vi Translation3d_Create_Default.vi Translation3d_Create_DistAng.vi Translation3d_Div.vi Translation3d_Equals.vi	Function Prototype	Notes	Code Reviev	Test Progra	Error Ch

	1/06/2022 – added various routines					-				
TWISTO	X	X	X	SI	Translation3d_Interpolate.vi					
X			X	SI						
			$\frac{1}{x}$	SI						
			$\frac{x}{x}$	SI	Translation3d Times.vi					
Yes			X	SI						
TWIST20	X		X	SI	Translation3d_UnaryMinus.vi					
TWISTIA X X X X X X X X X	TWIST2D \widetilde{X}	X	Wenu X	Secution Test Routi	Twist2d_Create.vi	twist new(x, y, theta)	Notes	Code Review	Test Program	Error Checking
Part	X	X	X	51	Twist2d_Equals.VI	boolean equals(obj otner)				
TWISTAD X X X X S S X Trivist25 Ceate vi	mplemented	Documented Not WPILIB	Menu Item	Execution Optimized Test Routine	Sample Program Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
CHASSIS SPEEDS X X X X S X X PWistGM_GetAll VI Function Prototype	TWIST3D X	X	X	SI X	Twist3d_Create.vi					
CHASSIS SPEEDS X X X X X X SI ChassisSpeeds FromFieldRelativeSpeeds VI chassisSpeeds fromFieldRelativeSpeeds (double x:double x:d			X	SI X						
CHASSIS SPEEDS X X X S S U ChassisSpeeds FromFieldRelativeSpeeds.VI ChassisSpeeds (duble x, double x, doub	<u> X</u>	XX	X	SI X	Twist3d_GetAll.VI					
CHASSIS SPEEDS X X X X S S ChassisSpeeds_FromFieldRelativeSpeeds VI chassisSpeeds fromFieldRelativeSpeeds VI double anyel rotation2d robotangle y double anyel, rotation2d robotangle y compared to the speed from Field RelativeSpeeds (double x, double y, double anyel, d	: Jemented	cumented WPILIB	nu Item		nple Program			de Review	st Program	
CHASSIS SPEEDS X X X X S S ChassisSpeeds, FromFieldRelativeSpeeds, VI chassisSpeeds fromFieldRelativeSpeeds, VI chassisSpeeds fromFieldRelativeSpeeds (double x, double y, double angvel, totatonad robotangle) X X X X X S S I ChassisSpeeds GetXYOmega.vi ChassisSpeeds new (double xvel, double yvel, double angvel) ChassisSpeeds new (double angvel) ChassisSpeeds new (do	<u>I</u>	Not Do	Me				Notes	Ö	7es	Ern
X X X X X X X X X X	CHASSIS SPEEDS X	X	X	SI	ChassisSpeeds_FromFieldRelativeSpeeds.VI	chassisspeeds fromFieldRelativeSpeeds(double x, double y,				
Chassisspeeds new () Can use cluster constant Chassisspeeds new () Chassisspeed new () Chassisspeed new () Chassi	X	XX	X	SI	ChassisSPeeds_GetXYOmega.vi	double ungvoi, rotationza robotangie)				
DIFFERENTIAL DRIVE KINEMATICS X X X X X DIffKinematics, IochassisSpeed.vi X X X X X DIffKinematics, IochassisSpeed.vi DiffKinematics, IochassisSpeed.vi Amely Page Water Mannage Water	X	X	X	SI	ChassisSpeeds_New.vi					
DIFFERENTIAL DRIVE KINEMATICS V X X X X X X X X X						chassisspeeds new ()	can use cluster constant			
X X X X DiffKinematics_toChassisSpeed.vi chassisSpeeds toChassisSpeeds (diffDrWheelSpeeds) X X X X X DiffKinematics_toWheelSpeed.vi diffDriveWheelSpeeds (chassisSpeeds) **The control of the control	Implemented	Documented Not WPILIB		Execution Optimized Test Routine			Notes	Code Review	Test Program	
X X X SI X DiffKinematics_toWheelSpeed.vi diffDriveWheelSpeeds (chassisSpeeds) X X X X X X X X X X	DIFFERENTIAL DRIVE KINEMATICS X	X	X	1 X	DiffKinematics_New.vi	diffDriveKine new(double trackWidth)				
Code Review Test Program										
DIFFERENTIAL DRIVE ODUMETRY X	Implemented	Documented Not WPILIB	ltem	Optimized ine	Sample Program Name			Code Review	Test Program	Error Checking
	DIFFERENTIAL DRIVE ODOMETRY	X			DIIIOdometry_Execute.VI		DON! NEED			

'======== KINEMATICS '========

/06/2022 – added various routines								_				
	X	X		X	X		DiffOdometry_Update.vi	pose2d update(rotation2d gyro, double leftdist, double right dist)	Incorporates enhanced reset			
								diffDrOdom new(rotation gyro, pose initial)				
								diffDrOdom new(rotation gyro)				
								void resetPosition(pose2d, rotation2d)	incorporated into "update"			
								pose2d getPoseMeters()				
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DIFFERENTIAL DRIVE WHEEL SPEEDS		7	_ <	<) Virvaine	diffDrWheelSpeeds new()	Notes			
5 E. (E. (1) / E. (1) / E. (1) / E. (2) / E								diffDrWheelSpeeds new(double leftVel, double rightVel)				
	Χ	Χ		Χ	Χ		DiffWheel_Normalize.vi	void normalize(double maxVel)				
					_							
					sed							
					imi	Ş						6
	þ	þ	m		Opt	e i				×	E E	Checking
	ente	ente	Ţ,	шe	00	utine				9 V	ogre	Jec
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MECANUM DRIVE KINEMATICS	=	X	_ <	<i>X</i>	Ш	F (VI Name MecaKinematics_New.vi	Function Prototype	Notes	<u> </u>	<u> </u>	Ш
MEGANOM BRIVE RINEMATICS	X	X		X	X		MecaKinematics_New.vi MecaKinematics_SetInverseKinematics.vi					
	X	X		X	X		MecaKinematics_County of Schalabs.vi					
	X	X		X	X		MecaKinematics_ToWheelSpeeds.vi					
	Χ	Χ		Χ	Χ		MecaKinematics_ToWheelSpeedsZeroCenter.vi					
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MECANUM DRIVE MOTOR VOLTAGE	_	Q	_ <	~	Щ	F (5 VI Name	Function Prototype	Notes	<u> </u>	<u> </u>	Ш
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	Implemented	Documented	Not WPILIB	Menu Item	Execution Optim	Test Routine				Code	Test l	Error
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MECANUM DRIVE ODOMETRY			X	.,			MecaOdometry_Execute.vi					
•			Χ	X	<u> </u>		MecaOdometry_GetKinematics.vi MecaOdometry_GetPose.vi					
	X	X		X			MecaOdometry_GetPose.vi MecaOdometry_New.vi					
	X	X		X			MecaOdometry_NewDefaultPose.vi					
	X	X		X			MecaOdometry_Reset.VI					
	Χ	X		X			MecaOdometry_Update.vi					
	Χ	X		Χ			MecaOdometry_UpdateWithTime.vi					
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2 – added various routines										·			
MECANUM DRIVE WHEEL SPEEDS	Χ	X		X	SI			MecaWheel_New.Vi	public MecanumDriveWheelSpeeds(double				
								_	frontLeftMetersPerSecond, double frontRightMetersPerSecond,				
									double rearLeftMetersPerSecond, double				
									rearRightMetersPerSecond)				
	X	X	Χ	X	SI			MecaWheel_GetAll.vi	,				
	X	X		X	X			MecaWheel Normalize.vi	public void normalize(double				
									attainableMaxSpeedMetersPerSecond)				
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	Ē	Documentea	Not WPILIB	Menu Item	ŭ	Je 1	Sample	VI Name	Function Prototype	Notes	රි	Ţe	Ē
SWERVE DRIVE KINEMATICS	X	X	X	X				SwerveKinematics New4.VI	, , , , , , , , , , , , , , , , , , ,	For 4 module drives			
	X	X	Х	X				SwerveKinematics NewX.VI		uses array as input			
	X	X	X	X				SwerveKinematics_NormalizeWheelSpeeds.vi	public static void normalizeWheelSpeeds(SwerveModuleState[]	does array as input			
	^	_ ^	_ ^	^				owervertinematics_itormalizevirieelopeeds.vi	moduleStates, double attainableMaxSpeedMetersPerSecond)				
	X	X	X	X				SwerveKinematics_ToChassisSpeeds4.VI		For 4 module drives			
	X	X	X					SwerveKinematics_rochassisSpeedsX.VI		uses array as input			
	\hat{x}	X		$\frac{1}{X}$				SwerveKinematics_ToGhassisSpeedsX.vi	public SwerveModuleState[]	acco array as input			
	٨	^		^				Swei vertinerrialics_roswei verviodulestates.vr	toSwerveModuleStates(ChassisSpeeds chassisSpeeds,				
									Translation2d centerOfRotationMeters)				
	X	X		X				SwerveKinematics ToSwerveModuleStatesZeroCenter.VI	public SwerveModuleState[]				
	^	^		^				Oworvershiernatios_roowervervioudieotateszerooenter.vi	toSwerveModuleStates(ChassisSpeeds chassisSpeeds)				
									public SwerveDriveKinematics(Translation2d wheelsMeters)	variable parameters (replace with			
									public ower vebriver (inclinatios) (translation 24 who districters)	array and "4" calls)			
									public ChassisSpeeds toChassisSpeeds(SwerveModuleState	variable parameters (replace with			
									wheelStates)	array and "4" calls)			
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	mplemente	Documentec	Not WPILIB	Menu Item	Execution	Test Routine		VI Name	Function Proteture	Notes	Code Revie	Test	Error
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SWERVE DRIVE ODOMETRY		 		-				SwerveOdometry_Execute4.vi					
				.				SwerveOdometry_ExecuteX.vi					
	Χ	X		X				SwerveOdometry_GetPosition.VI	public Pose2d getPoseMeters()				
	X	X		X				SwerveOdometry_New.VI	public SwerveDriveOdometry(SwerveDriveKinematics kinematics				
									Rotation2d gyroAngle, Pose2d initialPose)				
	X	X		X				SwerveOdometry_NewZeroCenter.VI	public SwerveDriveOdometry(SwerveDriveKinematics kinematics				
				1					Rotation2d gyroAngle)				
	Χ	X		X				SwerveOdometry_ResetPosition.VI	public void resetPosition(Pose2d pose, Rotation2d gyroAngle)				
	Χ	Χ	X					SwerveOdometry_Update4.VI		For 4 module drives			
	Χ	Χ		X				SwerveOdometry_UpdateWithTime4.VI		For 4 module drives			
					Ι			SwerveOdometry UpdateWithTimeX.VI				_	
	X	X	X	X						uses array as input			
		X	X	X									
	Χ	X	X	X				SwerveOdometry_UpdateX.VI	public Pose2d updateWithTime(double currentTimeSeconds	uses array as input			
	Χ	X	X	X					public Pose2d updateWithTime(double currentTimeSeconds, Rotation2d gyroAngle, SwerveModuleState moduleStates)	uses array as input variable parameters (replace with array and "4" calls)			
	Χ	X	X	X					Rotation2d gyroAngle, SwerveModuleState moduleStates)	uses array as input variable parameters (replace with array and "4" calls)			
	Χ	X	X	X					Rotation2d gyroAngle, SwerveModuleState moduleStates) public Pose2d update(Rotation2d gyroAngle,	uses array as input variable parameters (replace with array and "4" calls) variable parameters (replace with			
	Χ	X	X	X					Rotation2d gyroAngle, SwerveModuleState moduleStates)	uses array as input variable parameters (replace with array and "4" calls)			
	Χ	X X	X	X	pé				Rotation2d gyroAngle, SwerveModuleState moduleStates) public Pose2d update(Rotation2d gyroAngle,	uses array as input variable parameters (replace with array and "4" calls) variable parameters (replace with			
	Χ	X X	X	X X	ized				Rotation2d gyroAngle, SwerveModuleState moduleStates) public Pose2d update(Rotation2d gyroAngle,	uses array as input variable parameters (replace with array and "4" calls) variable parameters (replace with			
	Χ	X X	X	X X	timized		am		Rotation2d gyroAngle, SwerveModuleState moduleStates) public Pose2d update(Rotation2d gyroAngle,	uses array as input variable parameters (replace with array and "4" calls) variable parameters (replace with			51
	X X	X	X	X	Optimized	Đ.	am		Rotation2d gyroAngle, SwerveModuleState moduleStates) public Pose2d update(Rotation2d gyroAngle,	uses array as input variable parameters (replace with array and "4" calls) variable parameters (replace with	Me	ш	king
	X X	X	X	X	n Optimized	ıtine	Program		Rotation2d gyroAngle, SwerveModuleState moduleStates) public Pose2d update(Rotation2d gyroAngle,	uses array as input variable parameters (replace with array and "4" calls) variable parameters (replace with	sview	gram	ecking
	X X	X	X	X X	Ition Optimized	Soutine	Program		Rotation2d gyroAngle, SwerveModuleState moduleStates) public Pose2d update(Rotation2d gyroAngle,	uses array as input variable parameters (replace with array and "4" calls) variable parameters (replace with	Review	Program	Checking
	X X	X	X	X X	ecution Optimized	st Routine	Program		Rotation2d gyroAngle, SwerveModuleState moduleStates) public Pose2d update(Rotation2d gyroAngle,	uses array as input variable parameters (replace with array and "4" calls) variable parameters (replace with		it Program	or Checking
	X X	X	X	X X	Execution Optimized	Fest Routine	Program	SwerveOdometry_UpdateX.VI	Rotation2d gyroAngle, SwerveModuleState moduleStates) public Pose2d update(Rotation2d gyroAngle, SwerveModuleState moduleStates)	uses array as input variable parameters (replace with array and "4" calls) variable parameters (replace with array and "4" calls)		Fest Program	Error Checking
SWEDVE DDIVE MODULE STATE	X X X X X X X X X X	<i>X</i> Nocumented	Not WPILIB	Wenu Item	2 Execution Optimized	Test Routine	Sample Program	SwerveOdometry_UpdateX.VI VI Name	Rotation2d gyroAngle, SwerveModuleState moduleStates) public Pose2d update(Rotation2d gyroAngle, SwerveModuleState moduleStates) Function Prototype	uses array as input variable parameters (replace with array and "4" calls) variable parameters (replace with	Code Review	Test Program	Error Checking
SWERVE DRIVE MODULE STATE	X X Implemented	X Documented	X	X Wenu Item	SI	Test Routine	Sample Program	SwerveOdometry_UpdateX.VI VI Name SwerveModuleState_CompareTo.vi	Rotation2d gyroAngle, SwerveModuleState moduleStates) public Pose2d update(Rotation2d gyroAngle, SwerveModuleState moduleStates)	uses array as input variable parameters (replace with array and "4" calls) variable parameters (replace with array and "4" calls)		Test Program	Error Checking
SWERVE DRIVE MODULE STATE	X X Implemented	X Documented	X	X Wenu Item	SI SI	Test Routine	Sample Program	SwerveOdometry_UpdateX.VI VI Name SwerveModuleState_CompareTo.vi SwerveModuleState_Get.vi	Rotation2d gyroAngle, SwerveModuleState moduleStates) public Pose2d update(Rotation2d gyroAngle, SwerveModuleState moduleStates) Function Prototype public int compareTo(SwerveModuleState o)	uses array as input variable parameters (replace with array and "4" calls) variable parameters (replace with array and "4" calls)		Test Program	Error Checking
SWERVE DRIVE MODULE STATE	X X Implemented	X Documented	X	X Wenu Item	SI	Test Routine	Sample Program	SwerveOdometry_UpdateX.VI VI Name SwerveModuleState_CompareTo.vi	Rotation2d gyroAngle, SwerveModuleState moduleStates) public Pose2d update(Rotation2d gyroAngle, SwerveModuleState moduleStates) Function Prototype public int compareTo(SwerveModuleState o) public SwerveModuleState(double speedMetersPerSecond,	uses array as input variable parameters (replace with array and "4" calls) variable parameters (replace with array and "4" calls)		Test Program	Error Checking
SWERVE DRIVE MODULE STATE	X X Implemented	X Documented	X	X X Wenu Item	SI SI SI	Test Routine	Sample Program	SwerveOdometry_UpdateX.VI VI Name SwerveModuleState_CompareTo.vi SwerveModuleState_Get.vi SwerveModuleState_New.vi	Rotation2d gyroAngle, SwerveModuleState moduleStates) public Pose2d update(Rotation2d gyroAngle, SwerveModuleState moduleStates) Function Prototype public int compareTo(SwerveModuleState o) public SwerveModuleState(double speedMetersPerSecond, Rotation2d angle)	uses array as input variable parameters (replace with array and "4" calls) variable parameters (replace with array and "4" calls) Notes		Test Program	Error Checking
SWERVE DRIVE MODULE STATE	X X Implemented	X Documented	X	X Wenu Item	SI SI	Test Routine	Sample Program	SwerveOdometry_UpdateX.VI VI Name SwerveModuleState_CompareTo.vi SwerveModuleState_Get.vi	Rotation2d gyroAngle, SwerveModuleState moduleStates) public Pose2d update(Rotation2d gyroAngle, SwerveModuleState moduleStates) Function Prototype public int compareTo(SwerveModuleState o) public SwerveModuleState(double speedMetersPerSecond,	uses array as input variable parameters (replace with array and "4" calls) variable parameters (replace with array and "4" calls) Notes		Test Program	Error Checking

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	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checkina
CUBIC HERMITE SPLINE								•	protected SimpleMatrix getCoefficients()	not needed, use cluster unpack			
	X	X		X				CubicHermiteSpline_getControlVectorFromArrays.vi	private SimpleMatrix getControlVectorFromArrays(double[] initialVector, double[] finalVector)				
	X	X		X				CubicHermiteSpline_makeHermiteBasis.vi	private SimpleMatrix makeHermiteBasis()				
	X	X		X				CubicHermiteSpline_New.vi	public CubicHermiteSpline(double[] xInitialControlVector, double[] xFinalControlVector, double[] yInitialControlVector, double[] yFinalControlVector)				
POSE WITH CURVATURE	× Implemented	X Documented	Not WPILIB	Menu Item	ର Execution Optimized	Test Routine		VI Name PoseWithCurve_New.vi	Function Prototype public PoseWithCurvature(Pose2d poseMeters, double	Notes	Code Review	Test Program	Fror Checking
		^		^	·			1 00011111104110411111	curvatureRadPerMeter)				
									public PoseWithCurvature()	can use cluster constant			
									public Pose2d poseMeters	not needed, use cluster unpack			
									public double curvatureRadPerMeter	not needed, use cluster unpack			
	nented	nented	PILIB	Item	tion Optimized	Routine	le Progra				Review	rogram	:
QUINTIC HERMITE SPLINE		X Documented	Not WPILIB	X Menu Item	Execution Opt	Test Routine		VI Name QuinticHermiteSpline_getControlVectorFromArrays.vi	Function Prototype private SimpleMatrix getControlVectorFromArrays(double[] initialVector, double[] finalVector) private SimpleMatrix makeHermiteBasis()	Notes	Code Review	Test Program	Ĺ
UINTIC HERMITE SPLINE			Not WPILIB	Menu Item		Test Routine			private SimpleMatrix getControlVectorFromArrays(double[] initialVector, double[] finalVector) private SimpleMatrix makeHermiteBasis() public QuinticHermiteSpline(double[] xInitialControlVector, double[] xFinalControlVector.	Notes	Code Review	Test Program	
QUINTIC HERMITE SPLINE	X	X	Not WPILIB	X Menu Item		Test Routine		QuinticHermiteSpline_getControlVectorFromArrays.vi QuinticHermiteSpline_makeHermiteBasis.vi	private SimpleMatrix getControlVectorFromArrays(double[] initialVector, double[] finalVector) private SimpleMatrix makeHermiteBasis() public QuinticHermiteSpline(double[] xInitialControlVector,	Notes not needed, use cluster unpack	Code Review	Test Program	
	X	X X X X	Not WPILIB	X X Wenu Item		Test Routine Test Routine	Sample Program	QuinticHermiteSpline_getControlVectorFromArrays.vi QuinticHermiteSpline_makeHermiteBasis.vi QuinticHermiteSpline_New.vi	private SimpleMatrix getControlVectorFromArrays(double[] initialVector, double[] finalVector) private SimpleMatrix makeHermiteBasis() public QuinticHermiteSpline(double[] xInitialControlVector, double[] xFinalControlVector.		Code Review Code Review	Test Program Test Program	
	X	X X X X	Not WPILIB	Menu Item X X X Menu Item	Optimized Execution		Sample Program	QuinticHermiteSpline_getControlVectorFromArrays.vi QuinticHermiteSpline_makeHermiteBasis.vi QuinticHermiteSpline_New.vi	private SimpleMatrix getControlVectorFromArrays(double[] initialVector, double[] finalVector) private SimpleMatrix makeHermiteBasis() public QuinticHermiteSpline(double[] xInitialControlVector, double[] xFinalControlVector, double[] yInitialControlVector, double[] yFinalControlVector) protected SimpleMatrix getCoefficients() Function Prototype public PoseWithCurvature getPoint(double t) Spline(int degree)	not needed, use cluster unpack		Program	
	X	X X X X	Not WPILIB	Menu Item X X X Menu Item	Optimized Execution		Sample Program	QuinticHermiteSpline_getControlVectorFromArrays.vi QuinticHermiteSpline_makeHermiteBasis.vi QuinticHermiteSpline_New.vi	private SimpleMatrix getControlVectorFromArrays(double[] initialVector, double[] finalVector) private SimpleMatrix makeHermiteBasis() public QuinticHermiteSpline(double[] xInitialControlVector, double[] xFinalControlVector, double[] yInitialControlVector, double[] yFinalControlVector) protected SimpleMatrix getCoefficients() Function Prototype public PoseWithCurvature getPoint(double t) Spline(int degree) public static class ControlVector	not needed, use cluster unpack Notes		Program	
UINTIC HERMITE SPLINE	X	X X X X	Not WPILIB	Menu Item X X X Menu Item	Optimized Execution		Sample Program	QuinticHermiteSpline_getControlVectorFromArrays.vi QuinticHermiteSpline_makeHermiteBasis.vi QuinticHermiteSpline_New.vi	private SimpleMatrix getControlVectorFromArrays(double[] initialVector, double[] finalVector) private SimpleMatrix makeHermiteBasis() public QuinticHermiteSpline(double[] xInitialControlVector, double[] xFinalControlVector, double[] yInitialControlVector, double[] yFinalControlVector) protected SimpleMatrix getCoefficients() Function Prototype public PoseWithCurvature getPoint(double t) Spline(int degree)	not needed, use cluster unpack		Program	
	Implemented X X X	X X X X	Not WPILIB	Menu Item X X X Menu Item X X X Menu Item	Optimized Execution		Sample Program Sample Program	QuinticHermiteSpline_getControlVectorFromArrays.vi QuinticHermiteSpline_makeHermiteBasis.vi QuinticHermiteSpline_New.vi	private SimpleMatrix getControlVectorFromArrays(double[] initialVector, double[] finalVector) private SimpleMatrix makeHermiteBasis() public QuinticHermiteSpline(double[] xInitialControlVector, double[] xFinalControlVector, double[] yInitialControlVector, double[] yFinalControlVector) protected SimpleMatrix getCoefficients() Function Prototype public PoseWithCurvature getPoint(double t) Spline(int degree) public static class ControlVector	not needed, use cluster unpack Notes implemented as data structure		Program	

Y	Y		Y		X	SplineHelp GetCubicCtrlVectorsFromWayPts.vi	public static Spline.ControlVector[]		
^	^		^		^	Opiliter leip_detoubleotitvectorsi Torrivvayi ts.vi	getCubicControlVectorsFromWaypoints(Pose2d start,		
							Translation2d[] interiorWaypoints, Pose2d end)		
Χ	Χ	Χ	Х			SplineHelp GetCubicCtrlVectorsFromWeightedWayPts.vi	Translationza[] interior vraypointe; 1 03024 ond)		
Χ	Χ	Χ	No			SplineHelp_GetCubicSpline_Calc1.vi		internal	
Χ	X	Χ	No			SplineHelp_GetCubicSpline_Calc2.vi		internal	
Χ	X	Χ	No			SplineHelp_GetCubicSpline_Calc3.vi		internal	
Χ	Χ		X		X	SplineHelp_getCubicSplinesFromControlVectors.vi	public static CubicHermiteSpline[]		
							getCubicSplinesFromControlVectors(Spline.ControlVector start,		
							Translation2d[] waypoints, Spline.ControlVector end)		
X	X		X	SI		SplineHelp_GetQuinticCtrlVector.vi	private static Spline ControlVector getQuinticControlVector(double		
							scalar, Pose2d point)		
						SplineHelp_GetQuinticCtrlVectorsFromWayPts.vi	li i	REMOVED 2762	
							getQuinticControlVectorsFromWaypoints(List <pose2d></pose2d>		
							waypoints)		
						SplineHelp_GetQuinticCtrlVectorsFromWeightedWayPts.vi		REMOVED 2762	
Χ	X		X			SplineHelp_getQuinticSplinesFromControlVectors.vi	public static QuinticHermiteSpline[]		
						· · · · - · · · ·	getQuinticSplinesFromControlVectors(Spline.ControlVector[]		
							controlVectors)		
X	X	X	X			SplineHelp_GetQuinticSplinesFromWeightedWayPts.vi	,	New 2762	
Χ	X		X			SplineHelp_GetQuinticSplinesFromWayPts.vi		New 2762	
X	X		No			SplineHelp_ThomasAlgorithm.vi	private static void thomasAlgorithm(double[] a, double[] b, double[]	internal	
							c, double[] d, double[] solutionVector)		

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	 VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
SPLINE PARAMETERIZER	X	X		X			SplineParam_Spline_T0_T1.vi	public static List <posewithcurvature> parameterize(Spline spline double t0, double t1)</posewithcurvature>				
	X	X		Χ		Х	SplineParam_Spline.vi	public static List <posewithcurvature> parameterize(Spline spline)</posewithcurvature>				
	X	Χ	Χ	No			SplineParam_StackGet.vi		internal			
	Χ	Χ	Χ	No			SplineParam_StackPop.vi		internal			
	X	X	X	No			SplineParam_StackPush.vi		internal			

'======== TRAJECTORY '=======

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	Function Prototype	Notes	Code Review	Test Program	Error Checking
TRAJECTORY		X		X			Trajectory_Concatenate.vi					
	Χ	X		X			Trajectory_equals.vi	boolean equals(other obj)	FUTURE			
	Χ	X		X	SI		Trajectory_GetStates.vi	public List <state> getStates()</state>	not needed, use unpack			
	Χ	Χ		X	SI		Trajectory_GetTotalTime.vi	public double getTotalTimeSeconds()	not needed, use unpack			
	X	X		No	SI		Trajectory_lerp_double.vi	private static double lerp(double startValue, double endValue, double t)	internal			
	X	X		No	SI		Trajectory_lerp_Pose.vi	private static Pose2d lerp(Pose2d startValue, Pose2d endValue, double t)	internal			
	X	X		X	SI		Trajectory_New_Empty.vi					
	Χ	Χ		X	SI		Trajectory_New.vi	public Trajectory(final List <state> states)</state>				
	Χ	Χ		X			Trajectory_RelativeTo.vi	public Trajectory relativeTo(Pose2d pose)				
	Χ	Χ		X			Trajectory_Sample.vi	public State sample(double timeSeconds)				
•	X	X	X	X			Trajectory_SampleReverse.vi		Sample in reverse order. Negate sample.			
	Χ	Χ		X			Trajectory_TransformBy.vi	public Trajectory transformBy(Transform2d transform)				
								public Pose2d getInitialPose()	can use cluster unpack, array index			

FRC_LabVIEW_Trajectory_Library_Routines.xlsx Page 16 / 38 FRC LabVIEW Trajectory Library - VI Implementation List Revision 2.X 11/06/2022 – added various routines Execution Optimized Routine WPILIB Menu Item Not **Function Prototype** Notes TRAJECTORY_STATE X X TrajectoryState Equals.vi X SI boolean equals(other obj) X X SI TrajectoryState GetAll.vi Χ Χ XX X SI TrajectoryState GetPose.vi X X TrajectoryState Interpolate.vi Χ State interpolate(State endValue, double i) X Χ SI TrajectoryState New.vi Χ public State(double timeSeconds, double velocityMetersPerSecond, double accelerationMetersPerSecondSq, Pose2d poseMeters, double curvatureRadPerMeter) public State() Execution Optimizea Routine Venu Item Function Prototype VI Name Notes Implemented differently, can't TRAJECTORY CONFIG TrajectoryConfig AddConstraint.vi public TrajectoryConfig addConstraint(TrajectoryConstraint constraint) duplicate. TrajectoryConfig AddConstraints.vi public TrajectoryConfig addConstraints(List<? extends Χ Implemented differently, can't TrajectoryConstraint> constraints) public TrajectoryConfig(double maxVelocityMetersPerSecond. Χ X SI TrajectoryConfig Create.vi X double maxAccelerationMetersPerSecondSq) TrajectoryConfig_GetCentripetalAccel.vi X Χ X TrajectoryConfig GetConstraints.vi X Χ public List<TrajectoryConstraint> getConstraints() X Χ Implemented differently, can't can use cluster unpack XX X TrajectoryConfig GetEndVelocity.vi public double getEndVelocity() TrajectoryConfig GetKinematicsDiffDrive.vi $X \mid X$ X TrajectoryConfig GetKinematicsMecanumfDrive.vi XX X TrajectoryConfig_GetKinematicsSwerveDrive.vi Χ X X X Χ X TrajectoryConfig_GetMaxVelAccel.vi X X X TrajectoryConfig GetStartVelocity.vi public double getStartVelocity() can use cluster unpack TrajectoryConfig GetVoltageDiffDrive.vi X Χ Χ X X TrajectoryConfig IsReversed.vi public boolean isReversed() X can use cluster unpack X X SI Χ Χ TrajectoryConfig_setCentripetalAccel.vi X X TrajectoryConfig_SetEndVelocity.vi public TrajectoryConfig setEndVelocity(double endVelocityMetersPerSecond) public TrajectoryConfig setKinematics(DifferentialDriveKinematics X TrajectoryConfig setKinematicsDiffDrive.vi Χ Χ SI kinematics) Χ X Χ SI TrajectoryConfig setKinematicsMecanumfDrive.vi public TrajectoryConfig setKinematics(MecanumDriveKinematics kinematics) X X X SI TrajectoryConfig setKinematicsSwerveDrive.vi public TrajectoryConfig setKinematics(SwerveDriveKinematics kinematics) public TrajectoryConfig setReversed(boolean reversed) SI TrajectoryConfig_setReversed.vi Χ X X TrajectoryConfig_SetStartVelocity.vi public TrajectoryConfig setStartVelocity(double X X Χ startVelocityMetersPerSecond) TrajectoryConfig_setVoltageDiffDrive.vi X X X X SI public double getMaxVelocity() Created function to return both public double getMaxAcceleration() Created function to return both NOTE ADD OTHER "SET" ROUTINES FOR OTHER CONTRAINTS HERE, SINCE NEW CONTRAINTS ARE SPECIFIC AND NOT GENERIC.

Test Program est Routine Vot WPILIB Venu Item Function Prototype Notes

Revision 2.X 11/06/2022 – added various routines												
									1			
TRAJECTORY GENERATE	X	X		X			TrajectoryGenerate_Make_Cubic_CtrlVect.vi	initial, List <translation2d> interiorWaypoints, Spline,ControlVector</translation2d>	uses cubic splines			
		X		X			TrajectoryGenerate_Make_Cubic.vi	end, TrajectoryConfig config) public static Trajectory generateTrajectory(Pose2d start, List <translation2d> interiorWaypoints, Pose2d end, TrajectoryConfig config)</translation2d>	uses cubic splines			
	X	X	X	X			TrajectoryGenerate_Make_Generic.vi	Helper to bring these all together	Use this one!!!			
	X	X		X			TrajectoryGenerate_Make_Quintic_CtrlVect.vi	public static Trajectory generateTrajectory(ControlVectorList controlVectors, TrajectoryConfig config)	uses quintic splines			
	X	X	X				TrajectoryGenerate_Make_Quintic_Weighted.vi		New 2762			
	X	X		X	_		TrajectoryGenerate_Make_Quintic.vi TrajectoryGenerate_splinePointsFromSplines.vi	waypoints, TrajectoryConfig config) public static List <posewithcurvature></posewithcurvature>	uses quintic splines			
	mplemented	Documented	WPILIB	Item	Execution Optimized	est Routine		splinePointsFromSplines(Spline[] splines)		Review	rogram	Checking
)er	cnu	3	lenu	ကာမ	st Ro				Code	St F	9
	lm	ρŏ	Not	Me	Exe	7es	VI Name	Function Prototype	Notes	Õ	Test	Err
TRAJECTORY GENERATE (Control Vector)								·	may not need, just data			
,									may not need, just data			
									may not need, just data			
	'mplemented	ocumented	Vot WPILIB	Wenu Item	Execution Opt	Test Routine				ode Review	Test Program	Error Checking
		ρί			_ <u>~</u>	<u>6</u> 2		Function Prototype	Notes	Cod		Щ
TRAJECTORY PARAMETERIZE					\longrightarrow		TrajectoryParam_calcStuffFwd.vi					
	X	X	X				TrajectoryParam_calcStuffRev.vi		T			
	X	X	X	No No	_		TrajectoryParam_enforceAccel.vi TrajectoryParam_enforceVelocity.vi	List <trajectoryconstraint> constraints, ConstrainedState state)</trajectoryconstraint>	This routines needs to be changed when new constraints are added. This routines needs to be changed			
							T :		when new constraints are added.			
	X	X		X			TrajectoryParam_timeParam.vi	public static Trajectory timeParameterizeTrajectory(List <posewithcurvature> points. List<trajectoryconstraint> constraints, double startVelocityMetersPerSecond, double endVelocityMetersPerSecond, double maxVelocityMetersPerSecond, double maxAccelerationMetersPerSecondSq, boolean reversed)</trajectoryconstraint></posewithcurvature>				
	mplemented	<i>Documented</i>	Vot WPILIB	Venu Item	Execution Optimized	Test Routine	VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
TRAJECTORY PARAMETERIZE CONSTRAINED STATE				X Menu Item	Execution Optimized	Test Routine	ConstrainedState_New.vi	Function Prototype ConstrainedState(PoseWithCurvature pose, double distanceMeters, double maxVelocityMetersPerSecond, double minAccelerationMetersPerSecondSq, double maxAccelerationMetersPerSecondSq)	Notes	Code Review	Test Program	Error Checking
TRAJECTORY PARAMETERIZE CONSTRAINED STATE	X	X	X	X	Execution Optimized	Test Routine	ConstrainedState_New.vi ConstrainedState_SetMaxAccel.vi	ConstrainedState(PoseWithCurvature pose, double distanceMeters, double maxVelocityMetersPerSecond, double minAccelerationMetersPerSecondSq, double	Notes	Code Review	Test Program	Ŏ.
TRAJECTORY PARAMETERIZE CONSTRAINED STATE	X X X	X X X	X	X X X	Execution Optimized	Test Routine	ConstrainedState_New.vi	ConstrainedState(PoseWithCurvature pose, double distanceMeters, double maxVelocityMetersPerSecond, double minAccelerationMetersPerSecondSq, double	Notes	Code Review	Test Program	Ŏ.

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DIFF DRIVE KINEMATIC CONSTRAINT X X

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Revision 2.X 11/06/2022 – added various routines scution Optimized

	Jul	Doc	Not	Me	EXE	ŀ	es /	งี้ VI Name	Function Prototype	Notes	ŏ	7es	Em
TRAJECTORY UTIL	Χ	Χ		X				TrajectoryUtil_fromPathWeaverJSON.vi	public static Trajectory fromPathweaverJson(Path path)				
	Χ	Χ	X	X	X			TrajectoryUtil_MakeWeightedWayPoint_ENG.vi					
	Χ	X	X	X	X	'		TrajectoryUtil_MakeWeightedWayPoint.vi					
	X	X		X				TrajectoryUtil_toPathWeaverJSON.vi	public static void toPathweaverJson(Trajectory trajectory, Path path)				
									public static Trajectory deserializeTrajectory(String json)				
									public static String serializeTrajectory(Trajectory trajectory)				
					otimized			ram					

Function Prototype Notes TRAPEZOID PROFILE X X Χ TrapProfConstraint_New.vi X TrapProfile Calculate.vi XX No TrapProfile_Direct.vi Private, remove from menu X X X X TrapProfile_Execute.vi X X X X SI TrapProfile_Execute_AtGoal.vi XX Χ TrapProfile_IsFinished.vi XX X TrapProfile_New_DefInitial.vi XX X TrapProfile_New.vi Χ X No TrapProfile_ShouldFlipAcceleration.vi Private, remove from menu Χ Χ X TrapProfile_TimeLeftUntil.vi Χ Χ Χ TrapProfile_TotalTime.vi X X X TrapProfState_Equals.vi X X TrapProfState_New.vi

'======= TRAJECTORY CONSTRAINT '======== Menu Item Function Prototype Notes public double getMaxVelocityMetersPerSecond(Pose2d poseMeters, double curvatureRadPerMeter, double CENTRIPETAL ACCELERATION CONSTRAINT X Χ CentripetalAccelConstraint_getMaxVelocity.vi velocityMetersPerSecond) XX X CentripetalAccelConstraint_getMinMaxAccel.vi public MinMax getMinMaxAccelerationMetersPerSecondSq(Pose2d poseMeters, double curvatureRadPerMeter, double velocityMetersPerSecond) X SI public CentripetalAccelerationConstraint(double X CentripetalAccelConstraint_New.vi Can use cluster pack for now maxCentripetalAccelerationMetersPerSecondSq) Execution Optimized Not WPILIB Menu Item

DiffDriveKinematicsConstraint_getMaxVelocity.vi

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Function Prototype

velocityMetersPerSecond)

public double getMaxVelocityMetersPerSecond(Pose2d poseMeters, double curvatureRadPerMeter, double

Notes

2022 – added various routines									-	
	Χ	X		X				DiffDriveKinematicsConstraint_getMinMaxAccel.vi	public MinMax getMinMaxAccelerationMetersPerSecondSq(Pose2d poseMeters, double curvatureRadPerMeter, double velocityMetersPerSecond)	
	X	X		X	SI			DiffDriveKinematicsConstraint_New.vi	public DifferentialDriveKinematicsConstraint(final DifferentialDriveKinematics kinematics, double maxSpeedMetersPerSecond)	
DIFF DRIVE VOLTAGE CONSTRAINT	X Implemented	X Documented	Not WPILIB	X Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name DiffDriveVoltageConstraint_getMaxVelocity.vi DiffDriveVoltageConstraint_getMinMaxAccel.vi	Function Prototype public double getMaxVelocityMetersPerSecond(Pose2d poseMeters, double curvatureRadPerMeter, double velocityMetersPerSecond) public MinMax getMinMaxAccelerationMetersPerSecondSg(Pose2d poseMeters,	Notes
	X	X		X	SI			DiffDriveVoltageConstraint_New.vi	double curvatureRadPerMeter, double velocityMetersPerSecond) public DifferentialDriveVoltageConstraint(SimpleMotorFeedforward feedforward, DifferentialDriveKinematics kinematics, double maxVoltage)	
ELLIPTICAL REGION CONSTRAINT	X X Implemented	X X Documented	Not WPILIB	X X Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name EllipRegionConstraint_getMaxVelocity.vi EllipRegionConstraint_getMinMaxAccel.vi EllipRegionConstraint_IsPoseInRegion.vi EllipRegionConstraint_New.vi	Function Prototype	Notes
JERK CONSTRAINT	/ / Implemented	Documented	X X Not WPILIB	Menu Item	Secution Optimized	Test Routine	Sample Program	VI Name JerkConstraint_getMaxVelocity.vi JerkConstraint_getMinMaxAccel.vi JerkConstraint_New.vi	Routine exists, it is just a shell Routine exists, it is just a shell	Notes FUTURE FUTURE FUTURE
MAX VELOCITY CONSTRAINT	X X Implemented	X X Documented	Not WPILIB	X X Menu Item	S S Execution Optimized	Test Routine	Sample Program	VI Name MaxVelocityConstraint_getMaxVelocity.vi MaxVelocityConstraint_getMinMaxAccel.vi MaxVelocityConstraint_New.vi	Function Prototype	Notes

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11/06/2022 – added various routines									-	
1 1/00/2022 added various routiles					ā					
MECANUM DRIVE KINEMATICS CONSTRAINT	X X Implemented	X X Documented	Not WPILIB	X X Menu Item	ত Execution Optimized	Test Routine	Sample Program	VI Name MecaDriveKinematicsConstraint_getMaxVelocity.vi MecaDriveKinematicsConstraint_getMinMaxAccel.vi MecaDriveKinematicsConstraint_New.vi	Function Prototype	Notes
					~					
RECTANGULAR REGION CONSTRAINT [X Implemented	X Documented	Not WPILIB	X Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name RectRegionConstraint_getRectRegion.vi	Function Prototype	Notes
	Χ	X		X				RectRegionConstraint_getMinMaxAccel.vi		
	X	X		X				RectRegionConstraint_IsPoseInRegion.vi		
	X	X		X				RectRegionConstraint_New.vi		
L			l			l		r teeti tegieri eeristi airit_i tew.vi		
SWERVE DRIVE KINEMATICS CONSTRAINT	X Implemented	X Documented	Not WPILIB	X Menu Item	ত্ৰ Execution Optimized	Test Routine		VI Name SwerveDriveKinematicsConstraint_getMaxVelocity.vi SwerveDriveKinematicsConstraint_getMinMaxAccel.vi SwerveDriveKinematicsConstraint_New.vi	public double getMaxVelocityMetersPerSecond(Pose2d poseMeters, double curvatureRadPerMeter, double velocityMetersPerSecond) public MinMax getMinMaxAccelerationMetersPerSecondSq(Pose2d poseMeters, double curvatureRadPerMeter, double velocityMetersPerSecond)	Notes Can use cluster pack for now
	^	^		^	31			SwerveDriveRinematicsConstraint_INew.vi	SwerveDriveKinematics kinematics, double	Can use cluster pack for now
									maxSpeedMetersPerSecond)	
TRAJECTORY CONSTRAINT	Implemented $X \mid X \mid$ Implemented	Documented X X Documented	Not WPILIB X X Not WPILIB	Menu Item X X X Menu Item	Execution Optimized Execution Optimized	Test Routine Test Routine	mple Program	VI Name TrajConstraint_GetMaxVelocity.vi TrajConstraint_GetMinMaxAccel.vi TrajConstraint_GetType.vi	Function Prototype	Notes
			Ž			<u> </u>	Ŋ	VI Name		Notes
TRAJECTORY CONSTRAINT (Min Max)	Χ	Χ		X	SI			Constraint_MinMax_New.vi	Constraint_MinMax_New	
	Χ	X		X	SI			Constraint_MinMax_NewMinMax.VI	Constraint_MinMax_New	

'========= UTILITY

'======

THESE ROUTINES ARE SPECIFIC TO LABVIEW. THEY DO NOT HAVE A

FRC_LabVIEW_Trajectory_Library_Routines.xlsx

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
UTIL	X	Χ	Χ	X	SI			Util ApproxEqual.vi		
	Χ	Χ	X	X				Util_Array_PoseWCurv_to_XY.vi		
	Χ	Χ	X	X	SI			Util_CalcDist.vi		
	Χ	Χ	X	X	SI			Util_GetLibraryVersion.vi		
	Χ	Χ	X	X	SI			Util_GetLibUsage.vi		
	Χ	Χ	X	X				Util_GetTime.vi		Once tested completely, this should be optimized!
•	Χ	Χ	Χ	No	N/A			Util_LibraryGlobals.vi		Global Variables – no block diag.
	Χ	Χ	X	X				Util Trajectory Absolute To Relative.vi		ű
	Χ	Χ	Χ	X				Util Trajectory ReadFile.vi		
•	Χ	Χ	Χ	X				Util_Trajectory_to_XY.vi		
	Χ	Χ	Χ	No				Util_Trajectory_WriteFile_Config.vi		internal
	Χ	Χ	Χ	No				Util_Trajectory_WriteFile_OneState.vi		internal
	Χ	Χ	Χ	X				Util_Trajectory_WriteFile_PathFinder.vi		
	Χ	Χ	Χ	No				Util_Trajectory_WriteFile_PathFinderConfig.vi		internal
	Χ	X	X	X				Util_Trajectory_WriteFile_Pathweaver.vi		
	Χ	Χ	Χ	No				Util_Trajectory_WriteFile_States.vi		internal
	Χ	Χ	Χ	No				Util_Trajectory_WriteFile_WayPoints.vi		internal
	Χ	Χ	Χ	X				Util_Trajectory_WriteFile.vi		
	Χ	Χ	Χ	X				Util_TrajectoryState_Meters_To_Inches.vi		
	Χ	Χ	X	X				Util_TrajState_to_DiffDrive_WheelPos.vi		
	Χ	Χ	Χ	X				Util_DispWaypoint_Eng_To_SI.vi		
	Χ	Χ	Χ	X				Util_DispWaypoint_To_CubicInput.vi		
	Χ	Χ	X	X				Util_DispWaypoint_To_QuinticInput.vi		
	Χ	Χ	X	X				Util_DispWeightedWaypiont_Eng_To_WeightedWaypoint		
	X	Χ	X	No				Util_DispWeightedWayPoint_To_WeightedWayPoint.vi		Sorry about the confusing name

'======= CONVERSIONS '========

THESE ROUTINES ARE SPECIFIC TO LABVIEW. THEY DO NOT HAVE A JAVA / C++ WPILIB EQUIVALENT

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimize	Test Routine	Sample Program	VI Name	Function Prototype	Notes
CONV	Χ	Χ	Χ	Χ	SI			Conv_AngleDegrees_Heading.vi		
	Χ	Χ	X	Χ	SI			Conv_AngleRadians_Heading.vi		
	Χ	Χ	Χ	Χ	SI			Conv_Centimeters_Meters.vi		
	Χ	Χ	Χ	Χ	SI			Conv_Deg_Radians.vi		
	Χ	Χ	X	Χ	SI			Conv_Deg_Rotations.vi		
	Χ	Χ	X	Χ	SI			Conv_Feet_Meters.vi		
	Χ	Χ	X	Χ	SI			Conv_GyroDegrees_Heading.vi		
	Χ	Χ	Χ	Χ	SI			Conv_Heading_AngleRadians.vi		
	Χ	Χ	Χ	Χ	SI			Conv_Inches_Meters.vi		
	Χ	Χ	Χ	Χ	SI			Conv_Kilograms_Pounds.vi		
	Χ	Χ	Χ	Χ	SI			Conv_Meters_Feet.vi		
	Χ	Χ	Χ	Χ	SI			Conv_Meters_Inches.vi		
	Χ	Χ	Χ	Χ	SI			Conv_Pose2d_SI_Eng.vi		
	Χ	Χ	Χ	Χ	SI			Conv_Pounds_Kilograms.vi		
	Χ	X	Χ	Χ	SI			Conv_Radians_Deg.vi		
	Χ	Χ	Χ	Χ	SI			Conv_Radians_Rotations.vi		
	Χ	Χ	Χ	Χ	SI			Conv_Rotations_Deg.vi		
	Χ	Χ	Χ	Χ	SI			Conv_Rotations_Radians.vi		
	X	X	X	X	SI			Conv Yards Meters.vi		

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	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
UNITS	Χ	Χ		Χ	SI			Units_DegreesToRadians.vi		
	Χ	Χ		Χ	SI			Units_DegreesToRotations.vi		
	Χ	Χ		Χ	SI			Units_FeetToMeters.vi		
	Χ	Χ		Χ	SI			Units_InchesToMeters.vi		
	Χ	Χ		Χ	SI			Units_MetersToFeet.vi		
	Χ	Χ		Χ	SI			Units_MetersToInches.vi		
	Χ	Χ		Χ	SI			Units_MillisecondsToSeconds.vi		
	Χ	Χ		Χ	SI			Units_RadiansPerSecondToRotationsPerMinute.vi		
	Χ	Χ		Χ	SI			Units_RadiansToDegrees.vi		
	Χ	Χ		Χ	SI			Units_RadiansToRotations.vi		
	Χ	Χ		Χ	SI			Units_RotationsPerMinuteToRadiansPerSecond.vi		
	Χ	Χ		Χ	SI			Units_RotationsToDegrees.vi		
	Χ	Χ		Χ	SI			Units_RotationsToRadians.vi		
	X	X		X	SI			Units_SecondsToMilliseconds.vi		

'========= PATHFINDER UTIL '========

THESE ROUTINES ARE SPECIFIC TO LABVIEW. THEY DO NOT HAVE A JAVA / C++ WPILIB EQUIVALENT

Function Prototype Notes PathfinderUtil_Continuous_Heading_Difference.vi
PathfinderUtil_OptimizeTrajectoryStates.vi
PathfinderUtil_ToTrajectory.vi
PathfinderUtil_ToTrajectoryStates.vi

'======= STATE SPACE MODEL '========

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	 VI Name Function Prototype	Notes	Code Review	Test Program	Error Checking
DC MOTOR	Χ	Χ		Χ	SI		DCMotor_GetAndymark9015.vi				
	X	Χ		Χ	SI		DCMotor_GetAndymarkRs775_125.vi				
	X	Χ		Χ	SI		DCMotor_GetBag.vi				
	Χ	Χ		Χ	SI		DCMotor_GetBanebotsRs550.vi				
	Χ	Χ		Χ	SI		DCMotor_GetBanebotsRs775.vi				
	Χ	Χ		Χ	SI		DCMotor_GetCIM.vi				
	X	Χ		Χ	SI		DCMotor_GetCurrent.vi				
	Χ	Χ		Χ	SI		DCMotor_GetFalcon500.vi				
	Χ	Χ		Χ	SI		DCMotor_GetMiniCIM.vi				
	Χ	Χ		Χ	SI		DCMotor_GetNEO.vi				
	Χ	Χ		Χ	SI		DCMotor_GetNEO550.vi				
	Χ	Χ		Χ	SI		DCMotor_GetRomiBuiltIn.vi				
	X	Χ		Χ	SI		DCMotor_GetVex775Pro.vi				
	Χ	X		Χ	SI		DCMotor_New.vi				

XX	X SI	DCMotor_PickMotor.vi			

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	Function Prototype	Notes	Code Review	Test Program	Error Checking
LINEAR SYSTEM ID	Χ	Χ		Χ			LinearSystemId_CreateDCMotorSystem.vi					
	X	X		X			LinearSystemId_CreateDriveTrainVelocitySystem.vi		Update to use create matrix			
	X	X		X			LinearSystemId_CreateElevatorSystem.vi		Update to use create matrix			
	Χ	Χ		Χ			LinearSystemId_CreateFlywheelSystem.vi		Update to use create matrix			
	Χ	X		X			LinearSystemId_CreateSingleJointedArmSystem.vi		Update to use create matrix			
	Χ	Χ		Χ			LinearSystemId_IdentifyDriveTrainSystem.vi		Update to use create matrix			
	Χ	X		Χ			LinearSystemId_IdentifyPositionSystem.vi		Update to use create matrix			
	Χ	X		X			LinearSystemId_IdentifyVelocitySystem.vi		Update to use create matrix			

'======== STATE SPACE ESTIMATION '========

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimi:	Test Routine	รับ อัน อัน อัน VI Name Function Prototype	Notes	Code Review	Test Program	Error Checking
DIFFERENTIAL DRIVE POSE ESTIMATOR	X	Χ		X			DiffDrivePoseEst_AddVisionMeasurement.vi				
	X	Χ		X			DiffDrivePoseEst_FillStateVector.vi				
	Χ	Χ		X			DiffDrivePoseEst_GetEstimatedPosition.vi				
	Χ	Χ		X			DiffDrivePoseEst_Kalman_F_Callback.vi				
	X	Χ		X			DiffDrivePoseEst_Kalman_H_Callback.vi				
	Χ	Χ		X			DiffDrivePoseEst_New.vi				
	X	Χ		X			DiffDrivePoseEst_ResetPosition.vi				
	X	Χ		X			DiffDrivePoseEst_SetVisionMeasurementStdDevs.vi				
	Χ	Χ		X			DiffDrivePoseEst_Update.vi				
	Χ	Χ		X			DiffDrivePoseEst_UpdateWithTime.vi				·
	Χ	Χ		X			DiffDrivePoseEst_VisionCorrect_Callback.vi				
	Χ	Χ		X			DiffDrivePoseEst_VisionCorrect_Kalman_H_Callback.vi				

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optim	Test Routine	Sample Progran	VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
EXTENDED KALMAN FILTER	X	X		Χ				ExtendedKalmanFilter_Correct_OnlyUY.vi					
	X	X		Χ				ExtendedKalmanFilter_Correct.vi		Just a shell, not functional!			
	X	Χ		Χ				ExtendedKalmanFilter_GetP_Single.vi					
	X	Χ		Χ				ExtendedKalmanFilter_GetP.vi					
	X	X		Χ				ExtendedKalmanFilter_GetXHat_Single.vi					
	X	X		Χ				ExtendedKalmanFilter_GetXHat.vi					
	X	X		Χ				ExtendedKalmanFilter_New.vi					
	X	X		Χ				ExtendedKalmanFilter_Predict.vi					
	X	Χ		Χ				ExtendedKalmanFilter_Reset.vi					
	X	Χ		Χ				ExtendedKalmanFilter_SetP.vi					
	X	Χ		Χ				ExtendedKalmanFilter_SetXHat_Single.vi					
	X	Χ		Χ				ExtendedKalmanFilter_SetXHat.vi					

11/06/2022 – added various routines											
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KALMAN FILTER				X		X	KalmanFilter_Correct.vi				
	X			X			KalmanFilter_GetK				
	X	X		X			KalmanFilter_GetK_Single.vi				
	X	X		X			KalmanFilter_GetXHat				
	X	X		X		Χ	KalmanFilter_GetXHaT_Single				
	X	X		X		Χ	KalmanFilter_New.vi				
	X	X		X		X	KalmanFilter_Predict.vi				
	X	X		X			KalmanFilter_Reset.vi				
	X	X		X			KalmanFilter_SetXHat				
	X	X		X		X	KalmanFilter_SetXHat_Single				
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KALMAN FILTER LATENCY COMPENSATOR	X	X		X			KalmanFilterLatencyComp_AddObserverState.vi				
	X	X		X			KalmanFilterLatencyComp_ApplyPastGlobalMeas_FuncGroup.vi				
	X	X		X			KalmanFilterLatencyComp_ApplyPastGlobalMeasurement_UKF.vi				
	X	X		X			KalmanFilterLatencyComp_FindClosestMeasurement.vi				
	X			X			KalmanFilterLatencyComp_New.vi				
	X	X		X			KalmanFilterLatencyComp_Observer_New.vi				
	X	X		X			KalmanFilterLatencyComp_Reset.vi				
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	ďμ	Documente	Not WPILIB	Menu Item	Execution	Test Routine	ชื่อ อุโม ชับ VI Name Function Prototype	Notes	Code Reviev	est Program	ori:
MECANUM DRIVE POSE ESTIMATOR		<u> </u>	_<	_ <		_	MecaDrivePoseEst_AddVisionMeasurement_StdDev.vi	Notes			Ш
MEGANOM DRIVE FOSE ESTIMATOR		X		X			MecaDrivePoseEst_AddVisionMeasurement.vi			 	
	X	X		$\frac{\lambda}{X}$			MecaDrivePoseEst GetEstimatedPosition.vi				
	X			No			MecaDriveFoseEst_GeteStilinatedFostitoff.vi MecaDriveFoseEst_Kalman_F_Callback.vi				
	X	X		No			MecaDrivePoseEst Kalman H Callback.vi				
	X			X			MecaDrivePoseEst_New.vi				
	X			X			MecaDrivePoseEst ResetPosition.vi				
	X	X		X			MecaDrivePoseEst SetVisionMeasurementStdDevs.vi				
	X	X		X			MecaDrivePoseEst_Update.vi				
	X			X			MecaDrivePoseEst_UpdateWithTime.vi				
	X	X		No			MecaDrivePoseEst VisionCorrect Callback.vi				
	X			No			MecaDrivePoseEst VisionCorrect Kalman H Callback.vi				
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SWERVE DRIVE POSE ESTIMATOR	==	<u> </u>	_ <	_ ≥	Щ	_	VI Name Function Prototype SwerveDrivePoseEst AddVisionMeasurement StdDev.vi	INULES	U	<u> </u>	Ш
SVALIVAL DIVIAL LOSE ESTIMATOR		1					OWOLVODING GOELOL MUNICIONINICADUICHICH CIUDEN.VI	The state of the s	1	1	

X	X	X		SwerveDrivePoseEst_AddVisionMeasurement.vi	
X	X	X		SwerveDrivePoseEst_GetEstimatedPosition.vi	
X	X	X		SwerveDrivePoseEst_Kalman_F_Callback.vi	
X	X	X		SwerveDrivePoseEst_Kalman_H_Callback.vi	
X	X	X		SwerveDrivePoseEst_New.vi	
X	X	X		SwerveDrivePoseEst_ResetPosition.vi	
X	X	X		SwerveDrivePoseEst_SetVisionMeasurementStdDevs.vi	
X	X	X		SwerveDrivePoseEst_Update.vi	
X	X	X		SwerveDrivePoseEst_UpdateWithTime.vi	
X	X	X		SwerveDrivePoseEst_VisionCorrect_Callback.vi	
X	X	X		SwerveDrivePoseEst_VisionCorrect_Kalman_H_Callback.vi	

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Nample Program	Function Prototype	Notes	Code Review	Test Program	Error Checking
UNSCENTED KALMAN FILTER		X		X			UnscentedKalmanFilter_Correct_FuncGroup.vi					
	Χ	Χ		X			UnscentedKalmanFilter_Correct_OnlyUY.vi					
	Χ	Χ		X			UnscentedKalmanFilter_Correct_OnlyUYR.vi					
	Χ	X		X			UnscentedKalmanFilter_Correct.vi					
	Χ	Χ		X			UnscentedKalmanFilter_GetP_Single.vi					
	X	Χ		X			UnscentedKalmanFilter_GetP.vi					
	X	X		X			UnscentedKalmanFilter_GetXHat_Single.vi					
	X	Χ		X			UnscentedKalmanFilter_GetXHat.vi					
	X	Χ		X			UnscentedKalmanFilter_New_Default.vi					
	X	X		X			UnscentedKalmanFilter_New_FuncGroup.vi					
	Χ	Χ		X			UnscentedKalmanFilter_New.vi					
	Χ	Χ		X			UnscentedKalmanFilter_Predict.vi					
	Χ	X		X			UnscentedKalmanFilter_Reset.vi					
	Χ	Χ		X			UnscentedKalmanFilter_SetP.vi					
	Χ	Χ		X			UnscentedKalmanFilter_SetXHat_Single.vi					
	Χ	X		X			UnscentedKalmanFilter_SetXHat.vi					
	Χ	X		X			UnscentedKalmanFilter_Transform.vi					

'======== STATE SPACE CONTROL '=======

CONTROL AFFINE PLANT INVERSION FEEDFORWARD	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
DIFFERENTIAL DRIVE ACCELERATION LIMITER	X X Implemented	X X Documented	Not WPILIB	X X Menu Item	Execution Optimized	X X Test Routine		VI Name DiffDrvAccelLimit_Calculate.vi DiffDrvAccelLimit_New.vi	Function Prototype	Notes	Code Review	Test Program	Error Checking

Revision 2.X	11/06/2022 – added various routines

routines					
LINEAR SYSTEM	X	X	Χ	- 1	LinearSystem_CalculateX.vi

EM	X	X	X	- 1	LinearSystem_CalculateX.vi		
	X	Χ	X	- 1	LinearSystem_CalculateY.vi		
	X	X	X	SI	LinearSystem_GetA.vi		
	X	X	X	SI	LinearSystem_GetAElement.vi		
	X	X	X	SI	LinearSystem_GetB.vi		
	X	X	X	SI	LinearSystem_GetBElement.vi		
	X	Χ	X	SI	LinearSystem_GetC.vi		
	X	X	X	SI	LinearSystem_GetCElement.vi		
	X	X	X	SI	LinearSystem_GetD.vi		
	X	X	X	SI	LinearSystem_GetD.vi LinearSystem_GetDElement.vi		
	X	Χ	X	SI	LinearSystem_New.vi		

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program				Code Review	Test Program	Error Checking
_			≥	_ ₹	Щ	7e	Sa	VI Name	Function Prototype	Notes	ပိ		En
LINEAR SYSTEM LOOP	Χ	X		X				LinearSystemLoop_ClampInput.vi					
	Χ	X		X				LinearSystemLoop_Correct.vi					
								LinearSystemLoop_GetClampFunction.vi					
	X	X		X				LinearSystemLoop_GetController.vi					
	Χ	X		X				LinearSystemLoop_GetError_Single.vi					
	Χ	X		X				LinearSystemLoop_GetError.vi					
	Χ	Χ		X				LinearSystemLoop_GetFeedForward.vi					
	Χ	Χ		X				LinearSystemLoop_GetNextR_Single.vi					
	Χ	Χ		X				LinearSystemLoop_GetNextR.vi					
	Χ	Χ		X				LinearSystemLoop GetObserver.vi					
	Χ	Χ		X				LinearSystemLoop_GetU_Row.vi					
	Χ	Χ		X				LinearSystemLoop_GetU.vi					
	Χ	X		X				LinearSystemLoop_GetXHat_Single.vi					
	Χ	Χ		X				LinearSystemLoop GetXHat.vi					
								LinearSystemLoop_New_BBB					
								LinearSystemLoop_New_LinearSystem_ClampFunc					
	Χ	X		X				LinearSystemLoop New LinearSystem ClampVal.vi					
	Χ	X		X				LinearSystemLoop New.vi					
	Χ	X		X				LinearSystemLoop Predict.vi					
	Χ	X		X				LinearSystemLoop_Reset.vi					
								LinearSystemLoop_SetClampFunction.vi					
								LinearSystemLoop SetNextR Some.vi					
	Χ	X		X				LinearSystemLoop SetNextR.vi					
								LinearSystemLoop SetXHat Single.vi					
								LinearSystemLoop_SetXHat.vi					
								,					
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LTV DIFFERENTIAL DRIVE CONTROLLE

	Implen	Docum	Not WI	Menu I	Execut	Test R	Sampli	VI Name	Function Prototype	Notes	Code F	Test P	Error C
LER	Χ	Χ		Χ				LTVDiffDriveCtrl_Calculate.vi					
	Χ	Χ		Χ				LTVDiffDriveCtrl_New.vi					
	Χ	Χ		Χ				LTVDiffDriveCtrl_Calculate_TrajState.vi					
	Χ	X		Χ				LTVDiffDriveCtrl_Calculate_SetTolerance.vi					
	Χ	Χ		Χ				LTVDiffDriveCtrl_Calculate_AtReference.vi					

 added various routines 												
	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimizea	Test Routine	Nample Program	Function Prototype	Notes	Code Review	Test Program	Error Checking
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	Χ	X		Χ		Χ	LTVUnicycleCtrl_New.vi					
	Χ	X		Χ		Χ	LTVUnicycleCtrl_SetEnabled.vi					
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'========= STATE SPACE UTILITIES '======

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DIFFERENTIAL DRIVE TRAIN SIN	X X X X X X X X X X X X X X X X X X X	X		XX	Execution Optimized Test Routine	mesocade process	DiffDriveTrainSim_CreateKitbotSim_EstMass.vi DiffDriveTrainSim_CreateKitbotSim_EstMass.vi DiffDriveTrainSim_CreateKitbotSim_EstMassMOI.vi DiffDriveTrainSim_CreateKitbotSim.vi DiffDriveTrainSim_GetCurrentDrawAmps.vi DiffDriveTrainSim_GetCurrentGearing.vi DiffDriveTrainSim_GetDynamics.vi DiffDriveTrainSim_GetHeading.vi DiffDriveTrainSim_GetLeftCurrentDrawAmps.vi DiffDriveTrainSim_GetLeftCurrentDrawAmps.vi DiffDriveTrainSim_GetLeftPositionMeters.vi DiffDriveTrainSim_GetLeftVelocityMetersPerSecond.vi DiffDriveTrainSim_GetOutput_Single.vi DiffDriveTrainSim_GetRightCurrentDrawAmps.vi DiffDriveTrainSim_GetRightCurrentDrawAmps.vi DiffDriveTrainSim_GetRightCurrentDrawAmps.vi DiffDriveTrainSim_GetRightVelocityMetersPerSecond.vi DiffDriveTrainSim_GetRightVelocityMetersPerSecond.vi DiffDriveTrainSim_GetState_Single.vi DiffDriveTrainSim_GetState_vi DiffDriveTrainSim_GetState.vi DiffDriveTrainSim_KitBotWheelSize.vi DiffDriveTrainSim_New_Mass_MOI.vi DiffDriveTrainSim_New_Mass_MOI.vi DiffDriveTrainSim_SetCurrentGearing.vi DiffDriveTrainSim_SetCurrentGearing.vi	Function Prototype	Notes	Code Review	Test Program	Error Checking
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DIFFERENTIAL DRIVE TRAIN SIN	X X X X X X X X X X X X X X X X X X X	X		XX	Execution Optimized Test Routine	monoral Dronger	DiffDriveTrainSim_CreateKitbotSim_EstMass.vi DiffDriveTrainSim_CreateKitbotSim_EstMass.vi DiffDriveTrainSim_CreateKitbotSim_EstMassMOI.vi DiffDriveTrainSim_CreateKitbotSim.vi DiffDriveTrainSim_GetCurrentDrawAmps.vi DiffDriveTrainSim_GetCurrentGearing.vi DiffDriveTrainSim_GetDynamics.vi DiffDriveTrainSim_GetHeading.vi DiffDriveTrainSim_GetLeftCurrentDrawAmps.vi DiffDriveTrainSim_GetLeftCurrentDrawAmps.vi DiffDriveTrainSim_GetLeftPositionMeters.vi DiffDriveTrainSim_GetLeftVelocityMetersPerSecond.vi DiffDriveTrainSim_GetOutput_Single.vi DiffDriveTrainSim_GetRightCurrentDrawAmps.vi DiffDriveTrainSim_GetRightCurrentDrawAmps.vi DiffDriveTrainSim_GetRightCurrentDrawAmps.vi DiffDriveTrainSim_GetRightVelocityMetersPerSecond.vi DiffDriveTrainSim_GetRightVelocityMetersPerSecond.vi DiffDriveTrainSim_GetState_Single.vi DiffDriveTrainSim_GetState_vi DiffDriveTrainSim_GetState.vi DiffDriveTrainSim_KitBotWheelSize.vi DiffDriveTrainSim_New_Mass_MOI.vi DiffDriveTrainSim_New_Mass_MOI.vi DiffDriveTrainSim_SetCurrentGearing.vi DiffDriveTrainSim_SetCurrentGearing.vi	Function Prototype	Notes	Code Review	Test Program	Error Checking

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X	Χ	No		LinearSystemSim_UpdateX.vi			
X	XX	No		LinearSystemSim_UpdateY.vi			

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program		Function Prototype	Notes	Code Review	Test Program	Error Checking
SINGLE JOINT ARM SIM		Χ		Χ				SngJntArmSim_EsitmateMOI.vi					
	Χ	Χ		Χ				SngJntArmSim_GetAngleRads.vi					
	Χ	Χ		Χ				SngJntArmSim_GetCurrentDraw.vi					
	Χ	Χ		Χ				SngJntArmSim_GetVelocityRadsPerSec.vi					
	Χ	Χ		Χ				SngJntArmSim_HasHitLowerLimit.vi					
	Χ	Χ		Χ				SngJntArmSim_HasHitUpperLimit.vi					
	Χ	Χ		Χ				SngJntArmSim_New.vi					
	Χ	Χ		No				SngJntArmSim_Rkf45_Func.vi					
	Χ	Χ		Χ				SngJntArmSim_SetInputVoltage.vi					
	Χ	Χ		Χ				SngJntArmSim_SetState.vi					
	Χ	Χ		Χ				SngJntArmSim_Update.vi					
	Χ	Χ		Χ				SngJntArmSim_UpdateX.vi					
	Χ	Χ		Χ				SngJntArmSim_WouldHitLowerLimit.vi					
	Χ	Χ		Χ				SngJntArmSim_WouldHitUpperLimit.vi					

'======== MATRIX UTILITIES

> Function Prototype Notes MatBuilder_Create.vi
> MatBuilder_Fill.vi MAT BUILDER X X X SI X SI XX

	. Implemented	. Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
MATRIX	X	X		X	SI			Matrix_AssignBlock.vi					
	Χ	X		X	SI			Matrix_Block.vi					
		\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \		\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	0,			Matrix_ChangeBoundsUnchecked.vi					
	X	X		X	SI			Matrix_Create.vi					
								Matrix_Det.vi					
	Χ	X		X	SI			Matrix_Diag.vi					
								Matrix_Div_Scalar.vi		labview has function			
								Matrix_ElementPower.vi					
	Χ	X		X	SI			Matrix_ElementSum.vi					
								Matrix_ElementTimes.vi					
								Matrix_Equals.vi					
	Χ	X		X	1			Matrix_Exp.vi					
	Χ	X		X	SI			Matrix_ExtractColumnVector.vi					
	Χ	X		X	SI			Matrix_ExtractFrom.vi					
								Matrix_ExtractMatrix.vi					
	Χ	Χ		X	SI			Matrix_ExtractRowVector.vi					
	Χ	Χ		X	SI			Matrix_Fill.vi					
								Matrix_Get.vi		labview has function			

uo routinos												
us routines	Χ	V		Χ	,		Matrix Ident.vi		W/DILIP calls this EVE			
	X	X		Χ					WPILIB calls this EYE			
		V		V	CI		Matrix_Inv.vi					
	X	Χ		Χ	SI		Matrix_IsEqual.vi					
							Matrix_IsIdentical.vi					
	Χ	X		Χ	1		Matrix_LLTDecompose.vi					
							Matrix_Max.vi					
							Matrix_MaxAbs.vi					
							Matrix_Mean.vi					
							Matrix_MinInternal.vi					
							Matrix_Minus_Matrix.vi					
							Matrix_Minus_Scalar.vi					
	Χ	X		Χ	I		Matrix_NormF.vi					
							Matrix NormIndP1.vi					
							Matrix_Plus_Matrix.vi					
							Matrix_Plus_Scalar.vi					
	X	X		X	1		Matrix Pow.vi		THIS NEEDS WORK!!!!			
	X	X		X	SI		Matrix_SetColumn.vi		THIS NEEDS WORKS			
	X	X		X	SI		Matrix_SetRow.vi	THERE ARE LOTS OF OTHER MATRIX FUNCTIONS THAT				
	^	^		^	31		Mainx_Seirow.vi	SHOULD BE INCLUDED HERE FOR ISOLATION.				
							Matrix Solve.vi	SHOOLD BE INCLUDED HERE FOR ISOLATION.				
							Matrix Times Matrix.vi					
							Matrix_Times_Scalar.vi					
							Matrix Trace.vi					
	X	V		X	SI							
		X			Si		Matrix_Transpose.vi					
	X	X	Χ	Χ			Matrix_WithinTolerance.vi					
	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Programme NI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
SIMPLE MATRIX	X	X		X	SI		SimpleMatrix_ExtractMatrix.vi	7.	NOTE Matrix also has an ExtractMatrix with different calling parameters YUK.	0		
SIMPLE MATRIX MATRIX HELPER	X Implemented	X Documented	X Not WPILIB	X Menu Item X	ত Execution Optimized	Test Routine	SimpleMatrix_ExtractMatrix.vi	Function Prototype	NOTE Matrix also has an ExtractMatrix with different calling	Code Review		Error Checking
	X X Implemented	X X Documented	X X Not WPILIB	X Menu Item	ଦ୍ର ଓ Execution Optimized	Test Routine	SimpleMatrix_ExtractMatrix.vi		NOTE Matrix also has an ExtractMatrix with different calling parameters YUK.	Review		Error Checking
	X Implemented	X X Documented	X Not WPILIB	X Menu Item	ଦ୍ର ଓ Execution Optimized	Test Routine	SimpleMatrix_ExtractMatrix.vi		NOTE Matrix also has an ExtractMatrix with different calling parameters YUK.	Review		Error Checking
	X X Implemented	X X Documented	X X Not WPILIB	X X Menu Item	Optimized 99 99 Execution Optimized		SimpleMatrix_ExtractMatrix.vi WatrixHelper_CooerceSize.vi MatrixHelper_MultCooerceBSize.vi MatrixHelper_Zero.vi	Function Prototype	NOTE Matrix also has an ExtractMatrix with different calling parameters YUK. Notes	. Code Review	Test Program	Checking
MATRIX HELPER	Implemented X X Implemented	Documented X X X Documented	X X Not WPILIB	Menu Item X X Menu Item X	Execution Optimized 99 99 Execution Optimized	Test Routine Test Routine	SimpleMatrix_ExtractMatrix.vi Webbod Work WatrixHelper_CooerceSize.vi MatrixHelper_MultCooerceBSize.vi MatrixHelper_Zero.vi WatrixHelper_Zero.vi		NOTE Matrix also has an ExtractMatrix with different calling parameters YUK.	Review		Error
	X Implemented	X Documented X X X Documented	X X Not WPILIB	X Menu Item X X Menu Item X X X Menu Item X X X X X X X X X	2 Execution Optimized 2 2 2 Execution Optimized		SimpleMatrix_ExtractMatrix.vi Webboy VI Name MatrixHelper_CooerceSize.vi MatrixHelper_MultCooerceBSize.vi MatrixHelper_Zero.vi WatrixHelper_Zero.vi VI Name VecBuilder_1x1Fill.vi	Function Prototype	NOTE Matrix also has an ExtractMatrix with different calling parameters YUK. Notes	. Code Review	Test Program	Checking
MATRIX HELPER	X X Implemented X X Implemented	X X Documented	X X Not WPILIB	X Menu Item X X Menu Item X X	\Omega Execution Optimized \Omega \Omega Execution Optimized		SimpleMatrix_ExtractMatrix.vi WatrixHelper_CooerceSize.vi MatrixHelper_MultCooerceBSize.vi MatrixHelper_Zero.vi WatrixHelper_Zero.vi Working VI Name VecBuilder_1x1Fill.vi VecBuilder_2x1Fill.vi	Function Prototype	NOTE Matrix also has an ExtractMatrix with different calling parameters YUK. Notes	. Code Review	Test Program	Checking
MATRIX HELPER	X X Implemented X X Implemented	X X X Documented	X X Not WPILIB	X X Menu Item X X X Menu Item X	12 12 12 Execution Optimized 13 12 12 Execution Optimized		SimpleMatrix_ExtractMatrix.vi WatrixHelper_CooerceSize.vi MatrixHelper_MultCooerceBSize.vi MatrixHelper_Zero.vi WatrixHelper_Zero.vi Worship MatrixHelper_Zero.vi	Function Prototype	NOTE Matrix also has an ExtractMatrix with different calling parameters YUK. Notes	. Code Review	Test Program	Checking
MATRIX HELPER	X X Implemented X X Implemented	X X X Documented	X X Not WPILIB	X X Menu Item X X X Menu Item X	12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 <		SimpleMatrix_ExtractMatrix.vi WecBuilder_3x1Fill.vi VecBuilder_4x1Fill.vi VecBuilder_4x1Fill.vi VecBuilder_4x1Fill.vi VecBuilder_4x1Fill.vi VecBuilder_4x1Fill.vi	Function Prototype	NOTE Matrix also has an ExtractMatrix with different calling parameters YUK. Notes	. Code Review	Test Program	Checking
MATRIX HELPER	X X X Implemented	X X X Documented X X X Documented	X X Not WPILIB	X X X Menu Item X X X X	12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 <		SimpleMatrix_ExtractMatrix.vi ### SimpleMatrix_ExtractMatrix.vi ### Williams ### Williams ### Williams ### Williams ### Vil Name ### VecBuilder_1x1Fill.vi ### VecBuilder_2x1Fill.vi ### VecBuilder_3x1Fill.vi ### VecBuilder_4x1Fill.vi ### VecBuilder_5x1Fill.vi ### VecBuilder_5x1Fill.vi #### VecBuilder_5x1Fill.vi #### VecBuilder_5x1Fill.vi #### VecBuilder_5x1Fill.vi #### VecBuilder_5x1Fill.vi ##### VecBuilder_5x1Fill.vi ###################################	Function Prototype	NOTE Matrix also has an ExtractMatrix with different calling parameters YUK. Notes	. Code Review	Test Program	Checking
MATRIX HELPER	X X Implemented X X Implemented	X X X Documented	X X Not WPILIB	X X Menu Item X X X Menu Item X	12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 <		SimpleMatrix_ExtractMatrix.vi WecBuilder_3x1Fill.vi VecBuilder_4x1Fill.vi VecBuilder_4x1Fill.vi VecBuilder_4x1Fill.vi VecBuilder_4x1Fill.vi VecBuilder_4x1Fill.vi	Function Prototype	NOTE Matrix also has an ExtractMatrix with different calling parameters YUK. Notes	. Code Review	Test Program	Checking

X	X		X SI	VecBuilder_8x1Fill.vi			
				VecBuilder_9x1Fill.vi			
				VecBuilder_10x1Fill.vi			
X	X	X	X SI	VecBuilder_ArrayBy1Fill.vi			

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine Sample Program	VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
VECTOR	Χ	X		X	SI		Vector_Dot.vi					
	Χ	X		Χ	Si		Vector_Norm.vi					

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MATH '======

ANGLE STATISTICS		X Documented	X Not WPILIB	X Menu Item		Test Routine	EB DO	Function Prototype	Notes	Code Review	Test Program	Error Checking
	X X X	X X X	X	X	X		AngleStats_AngleAdd.vi AngleStats_AngleMean_CallbackHelp.vi AngleStats_AngleMean.vi					
	X	X	X	X	X I	X	AngleStats_AngleResidual_CallbackHelp.vi AngleStats_AngleResidual.vi					
MATH UTILITY	X X Implemented	X X X X X X X X X X X X X X X X X X X	Not WPILIB	X X X X X X X X X X X X X X X X X X X	SI SI	Test Routine	VI Name MathUtil_AngleModulus.vi MathUtil_ApplyDeadband.vi MathUtil_Clamp_Int.vi MathUtil_Clamp.vi MathUtil_InputModulus.vi MathUtil_Interpolate.vi	Function Prototype	Notes	Code Review	Test Program	Error Checking
MERWE SCALED SIGMA POINTS	X Implemented	X Documented	Not WPILIB	X Menu Item	- Execution Optimized	Test Routine	E E E E E E E E E E E E E E E E E E E	Function Prototype	Notes	Code Review	Test Program	Error Checking
MENTE COALLY COMA POINTS	Χ	Χ		X	SI		MerweScSigPts GetNumSigmas.vi					
	X	X		X		_	MerweScSigPts_GetWc_Single.vi					
	X	X		X	51	1	MerweScSigPts_GetWc.vi					
		X		X	SI		MerweScSigPts GetWm Single vi				1	1
	X	X		X	SI		MerweScSigPts_GetWm_Single.vi MerweScSigPts_GetWm.vi					

 added various routines 													
	X	X		Χ	1			MerweScSigPts_New.vi					
	Χ	Χ		X	1			MerweScSigPts_SigmaPoints.vi					
	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program				Review	Test Program	Error Checking
	gle	noc	z r	ent	GC	st	шt				Code	st	70.
			ž	Ž			Sa	VI Name	Function Prototype	Notes	ပ		Ţ
NUMERICAL INTEGRATION	X	X		$\mid x \mid$	1			NumIntegrate_Func_Ax_Bu_K.vi		NOT USED. Should this be used or abandoned???			
	X	Χ		X				NumIntegrate_Rk4_Dbl_X_U.vi					
	X	Χ		Χ				NumIntegrate_Rk4_Dbl_X.vi					
	X	Χ		Χ				NumIntegrate_Rk4_Mat_X_U.vi					
	X	Χ		Χ				NumIntegrate_Rk4_Mat_X.vi					
	X	Χ		No				NumIntegrate_Rkdp_Func_A.vi					
	X	Χ		No	SI			NumIntegrate_Rkdp_Func_B1.vi					
	X	X		No	SI			NumIntegrate_Rkdp_Func_B1B2.vi					
	Χ	X		No	SI			NumIntegrate_Rkdp_Func_B2.vi					
	X	Χ		No	1			Numintegrate_Rkdp_Impl.vi					
	X	Χ		X				NumIntegrate_RKDP_Mat_X_U.vi		New replacement for RKF45			
	Χ	Χ		No	SI			NumIntegrate_Rkf45_Func_A.vi					
	Χ	Χ		No	SI			NumIntegrate_Rkf45_Func_B1.vi					
	Χ	Χ		No	SI			NumIntegrate_Rkf45_Func_B1B2.vi					
	X	Χ		No	SI			NumIntegrate_Rkf45_Func_B2.vi					
								NumIntegrate_RKf45_Func_Bs.vi		Removed. Replaced with newer functions.			
								NumIntegrate_RKf45_Func_Ch.vi		Removed. Replaced with newer functions.			
								NumIntegrate_RKf45_Func_Ct.vi		Removed. Replaced with newer functions.			
	X	X		No X	ı			NumIntegrate_Rkf45_Impl.vi NumIntegrate_Rkf45_Mat_X_U.vi		Note that this Feinberg method has been changed and a Dormand Price method has been implemented TODO			
								NumIntegrate_RKf45_New.vi		Removed. Never used.			
	X	X	X	X	SI			NumIntegrate_Trap_Dbl.vi					
	Χ	Χ	Χ	Χ	1			NumIntegrate_Trap_Mat.vi					
					<i>σ</i>								
RUNGE KUTTA TIME VARYING	X Implemented	X Documented	Not WPILIB	S Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name RungeKuttaTimeVarying_RK4_Mat_T_Y.vi	Function Prototype	Notes	Code Review	Test Program	Error Checking
NUMERICAL JACOBIAN	X X Implemented	X X Documented	Not WPILIB	X Menu Item	Execution Optimized	Test Routine		VI Name NumJacobian_U.vi NumJacobian_X.vi	Function Prototype	Notes	Code Review	Test Program	Error Checking

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Nample Program	Function Prototype	Notes	Code Review	Test Program	Error Checking
RICCATI	Χ	Χ		Χ			Riccati_Check_Detectable.vi		Routine exists, it is just a shell			
	Χ	Χ		Χ			Riccati_Check_Stabilizable.vi		Not really done !!!			
							Riccati_DARE_Choose.vi		Intended to allow DARE method testing.			
	Χ	Χ	Χ	Χ		Χ	Riccati_DARE_Iterate.vi					
	Χ	Χ	Χ	Χ		Χ	Riccati_DARE_StructDoubling.vi					
	Χ	Χ		Χ			Riccati_DARE_N.vi					
	Χ	Χ		Χ		Χ	Riccati_DARE.vi					
	X	X		Χ			Riccati Input Check.vi					

'======= VISION

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Function Prototype Notes COMPUTER VISION UTILITIES X X CompVisionUtil_CalculateDistanceToTarget.vi CompVisionUtil_EstimateCameraToTarget.vi CompVisionUtil_EstimateFieldToCamera.vi X X X X X X X X X X X X Χ X CompVisionUtil_EstimateFieldToRobot.vi Χ Χ CompVisionUtil_EstimateFieldToRobot_Alt.vi

'======= TYPE DEFINITIONS '========

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimize	Test Routine	Sample Program	VI Name	Function Prototype	Notes
TypeDef	Ζ	Ζ	X	Χ	N/A			ARM_FF.CTL		
	Ζ	Ζ	X	Χ	N/A			BANG_BANG.CTL		
	1		X	Х	N/A			BICon-Matrix_FUNC_TYPE.CTL		NOT USED. Should this be deleted or abandoned???
	Ζ	Ζ	Χ	Χ	N/A			CALLBACK_FUNC_TYPE.CTL		
	Ζ	Ζ	X	Χ	N/A			CHASSIS_SPEEDS.CTL		
	Ζ	Ζ	X	Χ	N/A			CONTRAINED_STATE.CTL		
	Z	Ζ	X	Χ	N/A			COORDINATE_AXIS.CTL		
	Ζ	Ζ	Χ	Χ	N/A			COORDINATE_SYSTEM.CTL		
	Ζ	Ζ	Χ	Χ	N/A			DCMOTOR_TYPES_ENUM.CTL		
	Ζ	Ζ	Χ	Χ	N/A			DCMOTOR.CTL		
	Ζ	Ζ	Χ	Χ	N/A			DCMOTOR_SIM.CTL		
	Ζ	Ζ	Χ	Χ	N/A			DEBOUNCER_TYPE_ENUM.Ctl		
	Ζ	Ζ	Χ	Χ	N/A			DEBOUNCER.CTL		
	Ζ	Ζ	Χ	Χ	N/A			DIFF_DRIVE_ACCEL_LIMIT.CTL		
	Ζ	Ζ	Χ	Χ	N/A			DIFF_DRIVE_KINEMATICS.CTL		
	Ζ	Ζ	Χ	Χ	N/A			DIFF_DRIVE_Kitbot_WheelSize_ENUM.ctl		
	Ζ	Ζ	Χ	Χ	N/A			DiFF_DRIVE_Pose_EST.ctl		
	Ζ	Ζ	Χ	Χ	N/A			DIFF_DRIVE_ToughBoxMini_GearChoice_ENUM.ctl		
	Ζ	Ζ	Χ	Χ	N/A			DIFF_DRIVE_ToughBoxMini_MotorChoice_ENUM.ctl		
	Ζ	Ζ	Χ	Χ	N/A			DIFF_DRIVE_TRAIN_SIM_STATE_ENUM.CTL		

Z	Ζ	X	X	N/A	DIFF_DRIVE_TRAIN_SIM.ctl	
Z	Ζ	Χ	X	NA	DISPLAY_WAYPOINT.ctl	Was UTIL_WAYPOINT.VI
Z	Z	X	X	NA	DISPLAY_WEIGHTED_WAYPOINT.ctl	New V1.5. was
						UTIL_WEIGHTED_WAYPOINIT.VI
Z	Z	X	X	N/A	ELEV FF.CTL	
Z	Z	X	X	N/A	ELEVATOR SIM.CTL	
Z	Z	X	X	N/A	EXTENDED KALMAN CORRECT FUNC GROUP.CTL	
Z	_	X	X	N/A	EXTENDED KALMAN FILTER.CTL	
Z	Z	X	X	N/A	FLYWHEEL SIM.cti	
Z	Z	X	X	N/A	FUNCTION GENERATOR.ctl	
Z	Z	X	X	N/A	FUNCTION GENERATOR MATRIX.ctl	
Z	Ζ	X	X	N/A	HOLONOMIC DRV CTRL.CTL	New 1/26/21
Z	Ζ	Χ	X	N/A	TIME INTERPOLATABLE BOOLEAN.CTL	
Z	Ζ	Χ	X	N/A	TIME INTERPOLATABLE DOUBLE.CTL	
Z	Ζ	Χ	X	N/A	TIME_INTERPOLATABLE_POSE2D.CTL	
Z	Ζ	Χ	X	N/A	TIME_INTERPOLATABLE_ROTATION2D.CTL	
Z	Ζ	Χ	X	N/A	KALMAN_FILTER_LATENCY_COMP_FUNC_GROUP.CTL	
Z	Ζ	X	X	N/A	KALMAN_FILTER_LATENCY_COMP.CTL	
Z	Ζ	X	X	N/A	KALMAN_FILTER.ctl	
Z	Z	Χ	X	N/A	LINEAR_FILTER.CTL	
Z	Z	X	X	N/A	LINEAR_PLANT_INV_FF.ctl	
Z	Ζ	X	X	N/A	LINEAR_QUADRATIC_REGULATOR.ctl	
Z	Ζ	X	X	N/A	LINEAR_SYSTEM_LOOP.ctl	
Z	Ζ	X	X	N/A	LINEAR_SYSTEM_SIM.ctl	
Z	Ζ	X	X	N/A	LINEAR_SYSTEM.ctl	
Z	Z	X	X	N/A	LTV_DIFF_DRIVE_CTRL.ctl	
Z	Z	X	X	N/A	LTV_DIFF_DRIVE_CTRL_STATE_ENUM.ctl	
Z	Z	Χ	Χ	N/A	LTV_UNICYCLE_CONTROLLER.CTL	
N/A		N/A		N/A	LTV_UNICYCLE_CONTROLLER_INPUT_ENUM.ctl	OBSOLETE - Removed
Z	Z	X	X	N/A	LTV_UNICYCLE_CONTROLLER_STATE_ENUM.ctl	
Z	Z	X	X	N/A	MECA_DRIVE_KINEMATICS.CTL	
Z	Z	X	X	N/A	MECA_DRIVE_ODOMETRY.CTL	
Z	Z	X	X	N/A N/A	MECA_DRIVE_POSE_EST.CTL MECA_WHEEL_SPEEDS.CTL	
Z	Z	X	X	N/A	MEDIAN FILTER.CTL	
Z	Z	X	X	N/A	MERWE SCALED SIGMA PTS.ctl	
Z	Z	$\frac{\lambda}{X}$	$\frac{\lambda}{X}$	N/A	OBSERVER SNAP LIST ITEM.CTL	
Z	Z	X	X	N/A	OBSERVER_SNAP_LIST_ITEM.CTL OBSERVER SNAPSHOT.CTL	
Z	Z	X	X	N/A	PARAM STACK ITEM.CTL	
Z	Z	X	X	N/A	PARAM STACK.CTL	
Z	Z	X	X	N/A	PID ADV LIMITS.CTL	
Z	Z	X	X	N/A	PID ADV TUNING.CTL	
Z	Z		X			
Z	Z	X	X	N/A	PID ERROR TOLERANCE.CTL	
Z	Z	X	X	N/A	PID INPUT LIMITS.CTL	
Z	Z	X	X	N/A	PID TUNING.CTL	
Z	Z	X	X	N/A	POSE2D.CTL	
Z	Z	X	X	N/A	POSE3D.CTL	
Z	Z	Χ	X	N/A	POSEwCURVATURE.CTL	
Z	Z	X	X	N/A	PROFILED_PID_CONTROLLER.CTL	
Z	Z	X	X	N/A	QUATERNION.CTL	
Z	Ζ	Χ	X	N/A	RAMSETE_EXE_TUNING.CTL	
Z	Ζ	Χ	X	N/A	RAMSETE.CTL	
Z	Z	Χ	X	N/A	ROTATION2D.CTL	
Z	Z	X	X	N/A	ROTATION3D.CTL	
Z	Ζ	X	X	N/A	SIMPLE_MOTOR_FF.CTL	
Z	Z	X	X	N/A	SINGLE_JOINT_ARM_SIM.CTL	
Z	Z	X	X	N/A	SLEW_RATE_LIMITER.CTL	
Z	Z	X	X	N/A	SPLINE_CTRL_VECTOR.CTL	
Z	Z	X	X	N/A	SPLINE.CTL	
Z	Z	X	X	N/A	SWERVE_DRIVE_KINEMATICS.CTL	
Z	Z	X	X	N/A	SWERVE_DRIVE_ODOMETRY_CTL	
Z	Z	X	X	N/A	SWERVE_DRIVE_ODOMETRY.CTL	
Z	Z	X	X	N/A	SWERVE_DRIVE_Pose_EST.CTL	
Z	Z 7	X	X	N/A	TIMER.CTL	
Z	Ζ	X	X	N/A	TRAJ_CONFIG.CTL	

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Z	Ζ	X	Χ	N/A	TRAJ_CONSTRAINT_CENTRIPETAL_ACCEL.CTL	
Z	Ζ	X	Χ	N/A	TRAJ_CONSTRAINT_DIIF_DRIVE_KINEMATICS.CTL	
Z	Ζ	X	Χ	N/A	TRAJ_CONSTRAINT_DIIF_DRIVE_VOLTAGE.CTL	
Ζ	Ζ	X	Χ	N/A	TRAJ_CONSTRAINT_ELLIP_REGION.CTL	
1		X		N/A	TRAJ_CONSTRAINT_JERK.CTL	Routine exists, it is just a shell
Z	Ζ	X	Χ	N/A	TRAJ_CONSTRAINT_MAX_VELOCITY.CTL	
Z	Ζ	X	Χ	N/A	TRAJ_CONSTRAINT_MECA_DRIVE_KINEMATICS.CTL	
Z	Ζ	X	X	N/A	TRAJ_CONSTRAINT_MINMAX.CTL	
Z	Ζ	X	Χ	N/A	TRAJ_CONSTRAINT_RECT_REGION.CTL	
Z	Ζ	X	Χ	N/A	TRAJ_CONSTRAINT_SWERVE_DRIVE_KINEMATICS.CTL	
Z	Ζ	X	Χ	N/A	TRAJ_STATE.CTL	
Z	Ζ	X	X	N/A	TRAJECTORY_SPLINE_TYPE_ENUM.CTL	
Z	Ζ	X	Χ	N/A	TRAJECTORY.CTL	
Z	Ζ	X	X	N/A	TRANSFORM2D.CTL	
Z	Ζ	X	Χ	N/A	TRANSFORM3D.CTL	
Z	Ζ	X	Χ	N/A	TRANSLATION2D.CTL	
Z	Ζ	X	Χ	N/A	TRANSLATION3D.CTL	
Z	Ζ	X	X	N/A	TRAPEZOID_PROFILE_CONSTRAINT.CTL	
Z	Ζ	X	Χ	N/A	TRAPEZOID_PROFILE_STATE.CTL	
Z	Ζ	X	Χ	N/A	TRAPEZOID_PROFILE.CTL	
Z	Ζ	X	Χ	N/A	TWIST2D.CTL	
Z	Ζ	X	Χ	N/A	TWIST3D.CTL	
Z	Z	X	Χ	N/A	UNSCENTED_KALMAN_CORRECT_FUNC_GROUP.CTL	
Z	Ζ	X	Χ	N/A	UNSCENTED_KALMAN_FILTER.ctl	
Z	Ζ	X	Χ	N/A	UNSCENTED_KALMAN_NEW_FUNC_GROUP.CTL	
Z	Ζ	X	Χ	N/A	UTIL_PATHFINDER_CONFIG.CTL	
N/A		N/A		N/A	WAYPOINTS.CTL	Delete – obsolete
Z	Ζ	Χ	Χ	NA	WEIGHTED_WAYPOINT.CTL	New V1.5
N/A		N/A		N/A	X_Y_HEADINGS.CTL	Delete – obsolete
Z	Ζ	Χ	Χ	N/A	X_Y_PAIR.CTL	

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