Revision 3.05 3/01/2023 – Added execute routines for state space sim and ctrl

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 Vortified Weburn (Fig. 1125) 1123 CTL Total (Z) VI Shell Total (I) CTRL Shell Total (I) CTRL Shell Total (I) CTRL Shell Total (I) 2 VI Shell Total (II) 2 VI Shell Total (II

Doc completed Pct 99.14% Optimization Pct 60.00%

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

BASE '=======

ANALOG DELAY X X X X X I A AnalogDelay Execute.vi

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	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
BUMPLESS TRANSFER	Χ	Χ	Χ	Χ	1		BumplessTransfer_Execute.vi					

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimiz	Test Routine	Sample Program	VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
FUNCTION GENERATOR	X	X		X	Ī			FunctionGenerator_Add_Value.vi		Similar to interpolated tree map			
	X	X		Χ	1			FunctionGenerator_Add_XY.vi		Similar to interpolated tree map			
	X	X		X	1			FunctionGenerator_Calculate.vi		Similar to interpolated tree map			
	X	X		Χ	SI			FunctionGenerator_Clear.vi					
	X	X	X	Χ	1			FunctionGenerator_Execute.vi		Similar to interpolated tree map			
	Χ	X		X	SI			FunctionGenerator_New.vi		Similar to interpolated tree map			

Implemented Documented Not WPILIB	Menu Item Execution Optimized	Sample Program	VI Name	Function Prototype Notes	Code Review Test Program	Error Checking
FUNCTION GENERATOR MATRIX X X X	X I		FunctionGeneratorMatrix_Add.vi	Similar to	interpolated tree map	
$X \mid X \mid X$	X I		FunctionGeneratorMatrix_Calculate.vi	Similar to	interpolated tree map	
$X \mid X \mid X$	X SI		FunctionGeneratorMatrix_New.vi	Similar to	interpolated tree map	

FRC_LabVIEW_Trajectory_Library_Routines.xlsx

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X X X Revision 3.05 3/01/2023 – Added execute routines for state space sim and ctrl Function Prototype Notes LEAD LAG X X X X I LeadLag Execute.vi VI Name Function Prototype Notes LINEAR FILTER X X XI LinearFilter BackwardFiniteDifference.vi XX X SI LinearFilter Calculate.vi LinearFilter_CutoffFrequency.vi X X X X X X X X X I X LinearFilter Execute.vi Labview style helper LinearFilter Factorial.vi AN INTERNAL ROUTINE No I XX XI LinearFilter FiniteDifference.vi
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3/01/2023 – Added execute routines for state s	ER X X X X		Timer Close.vi		releases semaphore			
TIME	XXXX		X Timer Get.vi		Totalog Settlaphore			
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	X X X No		Timer GetInternal.vi		Internal (private) only			
	X X X X		X Timer HasPeriodPassed.vi		internal (private) only			
	X X X X		X Timer HasPeriodPassedOnce.vi					
	X X X		X Timer New.vi					
	X X X		X Timer Reset.vi					
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	X X X X		Timer Restart.vi		y , ,			
	X X X		X Timer Start.vi					
	X X X No		Timer StartInternal.vi					
	X X X		X Timer Stop.vi					
	X X X No		Timer_StopInternal.vi		Internal (private) only			
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	Impl Doc Not Men	Test	ຮັ້ງ VI Name	Function Prototype	Notes	ŏ	Test	
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	X X X No I		TimeInterpBoolean_CleanUp.vi		Update to use create matrix			
	X X X X SI		TimeInterpBoolean_Clear.vi					
	X X X X SI		TimeInterpBoolean_GetNewestSample.vi					
	X X X X I		TimeInterpBoolean_GetSample.vi					
			TimeInterpBoolean_GetTimeForValue.vi					
	X X X X SI		TimeInterpBoolean_New.vi					
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Revision 3.05 3/01/2023 – Added execute routines for state space sim and ctrl Function Prototype Notes TIME INTERPOLATABLE ROTATION2D XX TimeInterpRotation2d AddSample.vi Update to use create matrix X X X No I TimeInterpRotation2d CleanUp.vi Update to use create matrix TimeInterpRotation2d Clear.vi X X X X SI TimeInterpRotation2d_GetNewestSample.vi X X X X SI TimeInterpRotation2d GetSample.vi X X X X I TimeInterpRotation2d GetTimeForValue.vi X X X X SI TimeInterpRotation2d_New.vi X X X X SI TimeInterpRotation2d_PopOldestSample.vi TimeInterpRotation2d SetMaxTime.vi X X X X SI VI Name Function Prototype Notes X TIME INTERPOLATABLE VARIANT XXI TimeInterpVariant_AddSample.vi Update to use create matrix X No I TimeInterpVariant CleanUp.vi Update to use create matrix X X X X SI TimeInterpVariant_Clear.vi TimeInterpVariant_GetNewestSample.vi X X X X SI TimeInterpVariant_GetSample.vi X X X X I TimeInterpVariant GetTimeForValue.vi X X X X I TimeInterpVariant_Interpolate.vi This is a template for a user created routine. X X X X SI X X X X SI TimeInterpVariant_New.vi TimeInterpVariant_PopOldestSample.vi TimeInterpVariant SetMaxTime.vi X X X X SI Function Prototype Notes WAIT ADJUST X X X X WaitAdjust.vi Function Prototype Notes DIGITAL SEQUENTIAL LOGIC X X X X DigSeqLogic_Delay.vi XX XX DigSeqLogic_On_Delay.vi X X X X DigSeqLogic_Off_Delay.vi X X X X DigSeqLogic_One_Shot.vi $X \mid X \mid X \mid X$ DigSeqLogic_SR_Flip_Flop.vi Function Prototype Notes DEBOUNCER X X Debouncer_New.vi X
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			X					ArmFF_Execute.vi		LabVIEW style single call			
			X					ArmFF_ExecuteVelocityOnly.vi		LabVIEW style single call			
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	X	X		Χ				ArmFF_MaxAchieveVelocity.vi					
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BANG BANG		X		X	SI SI			BangBang_AtSetpoint.vi BangBang_Calculate_PV.vi					
	X	X		X	SI			BangBang_Calculate_Pv.vi BangBang_Calculate_SP_PV.vi					
	\hat{X}	Y	X	X	SI			BangBang_Execute.vi					
	X	X		X	SI			BangBang_GetAll.vi					
	X	X		X	SI			BangBang_GetError.vi					
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	X	X		X	SI			BangBang_SetSetpoint.vi					
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										still useful here.		l	<u> </u>
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023 – Added execute routines for state sp		nd ctrl									
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	XX	X				HolDrvCtrl_AdvCalculate.vi		Added 1/24/2022			
	XX		X	SI		HolDrvCtrl AtReference.vi		Added 1/26/21			
	XX		Χ	1		HolDrvCtrl_Calculate_Trajectory.vi		Added 1/26/21			
	XX		X	1		HolDrvCtrl_Calculate.vi		Added 1/26/21			
		X				HolDrvCtrl_Execute_Trajectory.vi		Added 1/24/2022			
	XX	X	X			HolDrvCtrl Execute.vi		Future	†		
	X X		X	SI		HolDrvCtrl New.vi		Added 1/26/21	 		
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	XX	X	X		X	PIDController_AdvExecute.vi		Labview style helper. Advanced			
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	XX			SI		PIDController_AtSetpoint.vi					
	XX		Χ			PIDController_Calculate_PV.vi					
	XX		Χ			PIDController_Calculate_SP_PV.vi					
	XX		X	SI		PIDController_DisableContinousInput.vi					
	XX		X	SI		PIDController_EnableContinousInput.vi					
	XX	X	X		X	PIDController Execute.vi		Labview style helper			
						PIDController GetContinuousError.vi		OBSOLETE – Removed			
	XX		Χ	SI		PIDController_GetPeriod.vi					
	XX		X			PIDController_GetPID.vi					
	X X		X		\neg	PIDController GetPositionError.vi			†		
	X X		X	SI	+	PIDController GetSetpoint.vi			T		
	X X		X		_	PIDController_GetTolerance.vi			+		
	$\begin{array}{ c c c c c }\hline X & X \\ \hline \end{array}$		X		-	PIDController_GetVelocityError.vi			+		
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		X			_	PIDController_Pack_AdvTuning.vi					
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	XX			SI		PIDController_SetD.vi					
	XX	X	X	SI		PIDController_SetDerivativeFilter.vi		Advanced PID			
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					E_DELETE.VI	DELETE DELETE	
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	XX	X	SI	ProfiledPIDController_EnableContIn	ut.vi		
	$X \mid X \mid X$	X X	1	ProfiledPIDController_Execute.vi		Single call LabVIEW style function.	
	XX	X	SI	ProfiledPIDController_GetGoal.vi			
	XX		SI	ProfiledPIDController_GetPeriod.vi		MDH ID has a superior matters	
	X X X		SI	ProfiledPIDController_GetPID.vi ProfiledPIDController_GetPositionEr	orvi	WPILIB has separate getters.	
	XX	- '	SI	ProfiledPIDController_GetPositionEr ProfiledPIDController_GetSetpoint.vi			
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	XX	X	SI	ProfiledPIDController_SetPID.vi			
	XX	X	SI	ProfiledPIDController SetTolerance	PosOnly.vi		
	XX	X	SI	ProfiledPIDController_SetTolerance	PosVel.vi		
	mplemented Jocumented	vor WPILIB Venu Item	Execution Optimized	Test Routine Sample Program ewen IA	Function Prototype	Notes Notes	i est Program
RAMSE	TE X X	\	SI	Ramsete AtReference.vi	AtReference	1,000	
. 3 41102	XX	X	X	Ramsete_Calculate_Trajectory.vi	calculate_trajectory		
	XX	X	X	Ramsete_Calculate.vi	calculate		
	XXX	X X	X	Ramsete_Diff_DO_Eng.vi			
	XXX	XX	X	Ramsete_Diff_DO_SI.vi	11-14-1-0		
	X X X	$\begin{array}{c c} x & X \\ Y & V \end{array}$		Ramsete_Execute_ENG.vi Ramsete Execute PackTuning EN	Use this one!!		
	XXXX	$\frac{\lambda}{\lambda} \mid \frac{\lambda}{\lambda}$	01	Ramsete_Execute_PackTuning_ENG Ramsete_Execute_PackTuning.vi	D.VI		
	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			Ramsete_Execute_PackTuning.vi			
							
	XX	X	SI	Ramsete New B Z.vi	new(b, zeta)		
	X X X X X X	X	SI SI	Ramsete_New_B_Z.vi Ramsete_New.vi Ramsete_SetEnabled.vi	new(b, zeta) new		

Revision 3.05 3/01/2023 – Added execute routines for state space sim and ctrl XX X Ramsete SINC.vi sinc internal Function Prototype Notes SIMPLE MOTOR FEEDFORWARD X X X X SI SimpleMotorFF Calculate CalcAccel.vi SimpleMotorFF Calculate NextV Dt.vi XX Χ X SI X SI SimpleMotorFF Calculate.vi public double calculate(double velocity, double acceleration) SimpleMotorFF_CalculateVelocityOnly.vi public double calculate(double velocity) X X X X SimpleMotorFF Ka AutoTune.vi SimpleMotorFF_MaxAchieveAccel.vi public double maxAchievableAcceleration(double maxVoltage, XX Χ double velocity) XX X SimpleMotorFF_MaxAchieveVel.vi public double maxAchievableVelocity(double maxVoltage, double acceleration) XX Χ SimpleMotorFF_MinAchieveAccel.vi public double minAchievableAcceleration(double maxVoltage, double velocity) SimpleMotorFF MinAchieveVel.vi XX Χ public double minAchievableVelocity(double maxVoltage, double acceleration) SimpleMotorFF New.vi public SimpleMotorFeedforward(double ks, double kv, double ka) Χ X X SI SimpleMotorFF Pack Ka Tune Params.vi $X \mid X \mid X \mid X \mid SI$ public SimpleMotorFeedforward(double ks, double kv) '======== GEOMETRY '======== Function Prototype Notes COORDINATE AXIS X X X SI CoordAxis D.vi CoordAxis_E.vi $X \mid X$ X SI X SI CoordAxis N.vi XX X SI CoordAxis New.vi XX X SI CoordAxis S.vi X SI CoordAxis_U.vi $X \mid X$ XX X SI CoordAxis W.vi Function Prototype Notes COORDINATE SYSTEM X X X SI X X SI CoordSystem Convert Pose3d.vi CoordSystem_Convert_Rotation3d.vi XX X SI CoordSystem_Convert_Translation3d.vi CoordSystem_Convert_Transform3d.vi $X \mid X$ X SI X SI X CoordSystem EDN.vi X SI X X SI X CoordSystem NED.vi CoordSystem_New.vi XX X SI X CoordSystem NWU.vi Function Prototype Notes POSE2D Pose2d_Div.VI $X \mid X$ X SI XX X SI Pose2d_Equals.VI boolean equals(other obj) X Pose2d Exp.vi pose2d exp(twist2d twist) X SI XX Pose2d_getRotation.vi rotation2d getRotation()

can also use cluster unpack

WPILib LabVIEW Math Library – VI Implementation List Revision 3.05 3/01/2023 – Added execute routines for state space sim and ctrl 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 X SI X X X X I Pose2d_getXYAngle.vi Pose2d Interpolate.vi XX XX Pose2d Log.vi twist2d log(pose2d end) XX X SI Pose2d Minus.vi transform2d minus(pose2d other) X SI Pose2d New TRRO.vi pose2d new(translation2d, rotation2d) $X \mid X \mid$ X X X X X SI X SI Pose2d New.vi pose2d new(double x, double y, rotation2d) Pose2d Plus.vi pose2d plus(transform2d other) XX X SI Pose2d RelativeTo.vi pose2d relativeto(pose2d other) X SI XX Pose2d Times.vi Pose2d_TransformBy.vi pose2d transformby(transform2d other) XX X SI pose2d new() can use cluster constant Function Prototype Notes POSE3D XX X SI Pose3d Div.vi X SI Pose3d Equals.VI XX XX XX Pose3d Exp.vi XX Pose3d_getRotation.vi X SI X X X X SI X X X X SI Pose3d getTranslation.vi Pose3d getXYZ.vi XX XI Pose3d Interpolate.vi XX XX Pose3d_Log.vi XX Pose3d Minus.vi X SI X SI X SI Pose3d New.vi XX Pose3d_New_Default.vi XX X SI Pose3d New Pose2d.vi Pose3d_New_Trans3dRot3d.vi X SI XX X SI X SI X X Pose3d Plus.vi Pose3d RelativeTo.vi XX No SI Pose3d RotationVectorToMatrix.vi Pose3d ToPose2d.vi XX X SI X SI Pose3d_Times.vi XX XX X SI Pose3d TransformBy.vi VI Name Function Prototype Notes QUATERNION X X X SI Quaternion Equals.vi $X \mid X$ X SI Quaternion Get All.vi X X Quaternion_Get_LVQuat.vi X SI X X X X X SI X SI Quaternion Get Vect.vi Quaternion_Get_W.vi XX X SI Quaternion Inverse.vi XX X SI Quaternion New.vi XX Quaternion_New_Default.vi X SI X X X X X SI X SI Quaternion New LVQuat.vi Quaternion Normalize.vi XX X SI Quaternion Plus.vi Quaternion_Times.vi $X \mid X \mid$ X SI Quaternion_ToRotationVector.vi X SI

Function Prototype

Notes

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ROTATION2D	Χ	X		

Х	(X		X	SI	Rotation2d_CreateAngle.vi	rotation2d new(double value)		
Х	(Χ		Χ	SI	Rotation2d_CreateAngleDegrees.vi	rotation2d fromDegrees(double degrees)	convert to radians then create	
Χ	7	X		Χ	SI	Rotation2d CreateAngleRotations.vi			
Х	₹	Χ		Χ	SI	Rotation2d_CreateXY.vi	rotation2d new(double x, double y)		
Χ	(X		Χ	SI	Rotation2d_Div.vi			
X	(X		Χ	SI	Rotation2d_Equals.vi	boolean equals(rotation2d other)		
Χ	(X	Χ	Χ	SI	Rotation2d_GetAngleCosSin.vi		New 1/26/21	
X	(Χ		Χ	SI	Rotation2d_GetCos.VI	double getCos()	use cluster unpack	
Х	(Х		X	SI	Rotation2d_GetDegrees.VI	double getDegrees()	use cluster unpack, then convert to degree	
Χ	←	X		Χ	SI	Rotation2d_GetRadians.VI	double getRadians()	use cluster unpack	
X	(X		Χ	SI	Rotation2d_GetRotations.vi			
X	(X		Χ	SI	Rotation2d_GetSin.VI	double getSin()	use cluster unpack	
Χ	(X		Χ	SI	Rotation2d GetTan.VI	double getTan()	can calculate	
Х	7	X		Χ	SI	Rotation2d Interpolate.vi	- "		
X	7	X		Χ	SI	Rotation2d Minus.vi	rotation2d minus(rotation2d other)		
X		X		Χ	SI	Rotation2d Plus.vi	rotation2d plus(rotation2d other)		
X	<i>(</i>	X		Χ	SI	Rotation2d RotateBy.vi	rotation2d rotateby(rotation2d other)		
Χ	(Χ		Χ	SI	Rotation2d_Times.vi	rotation2d times(double scalar)		
Χ	(Χ		Χ	SI	Rotation2d_UnaryMinus.vi	rotation2d unaryminus()		
							rotation2d 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
ROTATION3D	X	Χ		Χ	SI			Rotation3d_Create_AxisAngle.vi					
	X	Χ		Χ	SI			Rotation3d_Create_Default.vi					
	X	Χ		Χ	SI			Rotation3d_Create_Quaternion.vi					
	X	Χ		Χ	1			Rotation3d_Create_InitialFinalVector.vi					
	X	Χ		Χ	SI			Rotation3d_Create_RollPitchYaw.vi					
	X	Χ		Χ	1			Rotation3d_Create_RotMatrix.vi					
	X	Χ		Χ	SI			Rotation3d_Div.vi					
	X	Χ		Χ	SI			Rotation3d_Equals.vi					
	X	Χ	Χ	Χ	SI			Rotation3d_GetAxisAngle.vi					
	X	Χ		Χ	SI			Rotation3d_GetQuaternion.vi					
	X	Χ		Χ	SI			Rotation3d_GetXYZ.vi					
	X	Χ		Χ	SI			Rotation3d_Interpolate.vi					
	X	Χ		Χ	SI			Rotation3d_Minus.vi					
	X	Χ		Χ	SI			Rotation3d_Plus.vi					
	X	Χ		Χ	SI			Rotation3d_RotateBy.vi					
	X	Χ		Χ	SI			Rotation3d_Times.vi					
	X	Χ		Χ	SI			Rotation3d_ToRotation2d.vi					
	X	Χ		Χ	SI			Rotation3d_UnaryMinus.vi					

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimize	Test Routine	Sample Program	VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
TRANSFORM2D	X	Χ		Χ	SI			Transform2d_Create_PosePose.vi	transform2d new(pose2d, pose2d)				
	Χ	Χ		Χ	SI			Transform2d_Create_TransRot.vi	transform2d new(translation2d, rotation2d)				
	Χ	Χ		Χ	SI			Transform2d_Div.vi					
	Χ	Χ		Χ	SI			Transform2d_Equals.VI	boolean equals(other transform2d)				
	Χ	Χ		Χ	SI			Transform2d_GetRotation.VI	rotation2d getRotation()	use cluster unpack			
	Χ	Χ		Χ	SI			Transform2d_GetTranslation.VI	translation2d getTranslation()	use cluster unpack			
	Χ	Χ	X	Χ	SI			Transform2d_GetXY.vi					
	Χ	Χ	X	Χ	SI			Transform2d_GetXYAngle.vi					
	Χ	Χ		Χ	SI			Transform2d_Inverse.vi	transform inverse()	new			
	Χ	Χ		Χ	Si			Transform2d_Plus.vi					
	Χ	Χ		Χ	SI			Transform2d_Times.vi	transform2d times(double scalar)				
									transform2d new()	can use cluster constant			

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TWIST2	T Mplemented	X	Not W	X X	7 9 9 9 Execution Optimized	E.	VI Name Twist2d_Create.vi Twist2d_Equals.VI Twist2d_GetAll.VI	Function Prototype twist new(x, y, theta) boolean equals(obj other)	Notes	Code Review	Test Program	Error Checking
TWISTS	D X X	X X		X .	S S Execution Optimized X X Test Routine	,	VI Name Twist3d_Create.vi Twist3d_Equals.VI Twist3d_GetAll.VI	Function Prototype	Notes	Code Review	Test Program	Error Checking
'====== KINEMATICS '=========												
CHASSIS SPEED	X	X X Documented	Not N	X X	19 19 19 Execution Optimized Test Routine	Sample Program	VI Name ChassisSpeeds_FromFieldRelativeChassisSpeeds.VI ChassisSpeeds_FromFieldRelativeSpeeds.VI ChassisSPeeds_GetXYOmega.vi ChassisSpeeds_New.vi	Function Prototype chassisspeeds fromFieldRelativeSpeeds(double x, double y, double angvel, rotation2d robotangle) chassisspeeds new (double xvel, double yvel, double angvel) chassisspeeds new ()	Notes can use cluster constant	Code Review	Test Program	Error Checking
DIFFERENTIAL DRIVE KINEMATIO	X	X	Not N	X X	X X Test Routine		VI Name DiffKinematics_New.vi DiffKinematics_toChassisSpeed.vi	Function Prototype diffDriveKine new(double trackWidth) chassisSpeeds toChassisSpeeds(diffDrWheelSpeeds)	Notes	Code Review	Test Program	Error Checking
	X	X		X .	SI X	,	DiffKinematics_ToTwist2d.vi DiffKinematics_toWheelSpeed.vi	diffDriveWheelSpeed toWheelSpeeds(chassisSpeeds)				
DIFFERENTIAL DRIVE ODOMETRY	X Implemented		N to N	X Menu Item	Execution Optimized Test Routine	<u> </u>	VI Name DiffOdometry_Execute.vi DiffOdometry_Update.vi	Function Prototype pose2d update(rotation2d gyro, double leftdist, double right dis diffDrOdom new(rotation gyro, pose initial) diffDrOdom new(rotation gyro)		Code Review	Test Program	Error Checking
								void resetPosition(pose2d, rotation2d)	incorporated into "update"			

01/2023 – Added execute routines for state sp	ace si	m and	d ctrl					_				
'					jed Zed							
	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimiz	Test Routine	Nogram No	Function Prototype	Notes	Code Review	Test Program	Error Checking
DIFFERENTIAL DRIVE ODOMETRY 2	X	Χ	X	X	/		DiffDrvOdom2_Execute.vi		Replacement for orig diff drive			
	X	Χ	+	X	SI		DiffDrvOdom2_GetPose.vi		odom			
	X	X		X	1		DiffDrvOdom2_New.vi					
	Χ	Χ		Χ	SI		DiffDrvOdom2_Reset.vi					
	X	Χ		X	1		DiffDrvOdom2_Update.vi					
	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	Function Prototype	Notes	Code Review	Test Program	Error Checking
DIFFERENTIAL DRIVE WHEEL SPEEDS					_			diffDrWheelSpeeds new()				
	X	V			X		DiffMhool Normaliza vi	diffDrWheelSpeeds new(double leftVel, double rightVel)				
	X	X	1	_ X	X		DiffWheel_Normalize.vi	void normalize(double maxVel)				
MECANUM DRIVE KINEMATICS	X	X X Documented	Not WPILIB	X X X X X X X X X X X X X X X X X X X	X	Test Routine	Workinematics_New.vi MecaKinematics_New.vi MecaKinematics_SetInverseKinematics.vi MecaKinematics_ToChassisSpeeds.vi MecaKinematics_ToTwist2d.vi MecaKinematics_ToWheelSpeeds.vi MecaKinematics_ToWheelSpeeds.vi	Function Prototype	Notes	Code Review	Test Program	Error Checking
MECANUM DRIVE MOTOR VOLTAGE	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	Function Prototype	Notes	Code Review	Test Program	Error Checking
	hing do	one			1	1		1	I.			
	plemented	ocumented	Vot WPILIB	enu Item	cecution Optimized	Test Routine	Sample Program			Code Review	sst Program	ror Checking
MEGANUM DRIVE ORGANIZATION	7	Ğ		Ž	μÛ			Function Prototype	Notes	<u>`</u>	7e	Ē
MECANUM DRIVE ODOMETRY		X	X		X	1	MecaOdometry_Execute.vi MecaOdometry_GetKinematics.vi					
	X	X	X	X			MecaOdometry_GetKinematics.vi MecaOdometry_GetPose.vi					
	\hat{x}	X	+	X			MecaOdometry_New.vi					
	X	X		X			MecaOdometry_NewDefaultPose.vi					
	Χ	X		Χ			MecaOdometry_Reset.VI					
	X	Χ		X			MecaOdometry_Update.vi					
							MecaOdometry_UpdateWithTime.vi		Removed			

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public SwerveDriveOdometry(SwerveDriveKinematics kinematics, X SwerveOdometry_NewZeroCenter.VI X Rotation2d gyroAngle) $X \mid X$ X SI SwerveOdometry ResetPosition.VI public void resetPosition(Pose2d pose, Rotation2d gyroAngle) SwerveOdometry_Update4.VI X X X X For 4 module drives SwerveOdometry_UpdateWithTime4.VI REMOVED REMOVED SwerveOdometry_UpdateWithTimeX.VI X X X X SwerveOdometry UpdateX.VI uses array as input Х public Pose2d updateWithTime(double currentTimeSeconds, variable parameters (replace with Rotation2d gyroAngle, SwerveModuleState... moduleStates) array and "4" calls)

	Implemente	Documente	Not WPILIE	Menu Item	Execution (Test Routin	Sample And Manager	Function Prototype Notes	Code Revie	Test Progra	Error Check
SPLINE PARAMETERIZER	X	X		X			SplineParam_Spline_T0_T1.vi	public static List <posewithcurvature> parameterize(Spline spline, double t0, double t1)</posewithcurvature>			
	X	X		Х		X	SplineParam_Spline.vi	public static List <posewithcurvature> parameterize(Spline spline)</posewithcurvature>			
	X	X	X	No			SplineParam_StackGet.vi	internal			
	X	X	X	No			SplineParam_StackPop.vi	internal			
	Χ	X	X	No			SplineParam_StackPush.vi	internal			

'===== TRAJECTORY

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TRAJECTORY	, <u> </u>	X			i F	ຽ VI Name Trajectory_Concatenate.vi	Function Prototype Notes &	
TRAJECTORT	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$		X			Trajectory_concatenate.vi	boolean equals(other obj) FUTURE	
		\hat{x}	$\frac{1}{\lambda}$	(;	31	Trajectory_equals.vi	public List <state> getStates() not needed, use unpack</state>	
		X	$\frac{\hat{x}}{\hat{x}}$		S/	Trajectory_GetTotalTime.vi	public double getTotalTimeSeconds() not needed, use unpack	
		X	N		3/	Trajectory_lerp_double.vi	private static double lerp(double startValue, double endValue, internal	
	X	X	N	0	S <i>I</i>	Trajectory_lerp_Pose.vi	double t) private static Pose2d lerp(Pose2d startValue, Pose2d endValue, internal double t)	
	X		Χ	(;	SI	Trajectory_New_Empty.vi		
	X		Χ	(;	SI	Trajectory_New.vi	public Trajectory(final List <state> states)</state>	
	X	X	Χ	(Trajectory_RelativeTo.vi	public Trajectory relativeTo(Pose2d pose)	
	X	X	Χ	(Trajectory_Sample.vi	public State sample(double timeSeconds)	
	X	X	XX	(Trajectory_SampleReverse.vi	Sample in reverse order. Negate	
							sample.	
	X	X	X	(Trajectory_TransformBy.vi	public Trajectory transformBy(Transform2d transform)	
							public Pose2d getInitialPose() can use cluster unpack, array index	
	plemented	Documented	Not WPILIB		Execution Optin Test Routine	ample Progran	rde Review	st Program
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TRAJECTORY_STATE			λ	()	SI	TrajectoryState_Equals.vi	boolean equals(other obj)	
		X	X X	(;	SI	TrajectoryState_GetAll.vi		
		X	X	(;	SI	TrajectoryState_GetPose.vi		
		X	X	(SI	TrajectoryState_Interpolate.vi TrajectoryState_New.vi	State interpolate(State endValue, double i) public State(double timeSeconds, double velocityMetersPerSecond, double accelerationMetersPerSecondSq, Pose2d poseMeters, double curvatureRadPerMeter)	
	nted	nted	LIB		n Optimized Itine	Program	public State()	gram
	mented	mented	PILII	į į	uton Optimized Routine	le Program		Program
	olemented	umente	PILII	į į	ution Routi	mple.	de Review	~
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TRAJECTORY CONFIG	Implement	umente	PILII	יאפוום וופו	ution Routi	mple.	Function Prototype Notes Onlint.vi public TrajectoryConfig addConstraint(TrajectoryConstraint Implemented differently, can't	Progra
TRAJECTORY CONFIG	X Implement	Document	Not WPILII		ution Routi	VI Name TrajectoryConfig_AddConstrai	Function Prototype Function Prototype int.vi public TrajectoryConfig addConstraint(TrajectoryConstraint Implemented differently, can't duplicate.	Progra
TRAJECTORY CONFIG	X Implement	X Document	Not WPILII		ution Routi	Sample Solution Solut	Function Prototype Function Prototype Notes public TrajectoryConfig addConstraint(TrajectoryConstraint duplicate. public TrajectoryConfig addConstraints(List extends public TrajectoryConstraint constraint) TrajectoryConstraint constraints public TrajectoryConfig(double maxVelocityMetersPerSecond,	Progra
TRAJECTORY CONFIG	X Implement	X Document	Not WPILII		Execution Test Routi	VI Name TrajectoryConfig_AddConstrai TrajectoryConfig_AddConstrai	Function Prototype Function Prototype Notes O Inint.vi	Progra
TRAJECTORY CONFIG	X X X X	X Document	Not WPILII X		Execution Test Routi	VI Name TrajectoryConfig_AddConstrai TrajectoryConfig_AddConstrai TrajectoryConfig_Create.vi	Function Prototype Function Prototype Notes public TrajectoryConfig addConstraint(TrajectoryConstraint duplicate. Implemented differently, can't duplicate. public TrajectoryConfig addConstraints(List extends Implemented differently, can't duplicate. public TrajectoryConstraint constraints) public TrajectoryConfig(double maxVelocityMetersPerSecond, double maxAccelerationMetersPerSecondSq) etalAccel.vi ints.vi public List <trajectoryconstraint> getConstraints() Implemented differently, can't</trajectoryconstraint>	Progra
TRAJECTORY CONFIG	X X X Implement	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 X X X X X X X X X		Execution Test Routi	VI Name TrajectoryConfig_AddConstrai TrajectoryConfig_Create.vi TrajectoryConfig_GetCentripet TrajectoryConfig_GetConstrair	Function Prototype Function Prototype Notes public TrajectoryConfig addConstraint(TrajectoryConstraint constraint) public TrajectoryConfig addConstraints(List extends public TrajectoryConfig addConstraints(List<? extends TrajectoryConstraint constraints) public TrajectoryConstraint> constraints) public TrajectoryConfig(double maxVelocityMetersPerSecond, double maxAccelerationMetersPerSecondSq) etalAccel.vi public List <trajectoryconstraint> getConstraints() Implemented differently, can't duplicate.</trajectoryconstraint>	Progra
TRAJECTORY CONFIG	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 X X X X X X X X X	Not Well!		Execution Test Routi	VI Name TrajectoryConfig_AddConstrai TrajectoryConfig_AddConstrai TrajectoryConfig_Create.vi TrajectoryConfig_GetCentripet TrajectoryConfig_GetConstrain TrajectoryConfig_GetEndVeloc	Function Prototype Public TrajectoryConfig addConstraint(TrajectoryConstraint duplicate. Implemented differently, can't duplicate.	Progra
TRAJECTORY CONFIG	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 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		Execution Test Routi	VI Name TrajectoryConfig_AddConstrai TrajectoryConfig_AddConstrai TrajectoryConfig_Create.vi TrajectoryConfig_GetCentripet TrajectoryConfig_GetConstrair TrajectoryConfig_GetEndVeloc TrajectoryConfig_GetKinemati	Function Prototype Function Prototype public TrajectoryConfig addConstraint(TrajectoryConstraint constraint) public TrajectoryConfig addConstraints(List extends Implemented differently, can't duplicate. Implemented differently, can't duplicate. Implemented differently, can't duplicate. public TrajectoryConstraint constraints) public TrajectoryConfig(double maxVelocityMetersPerSecond, double maxAccelerationMetersPerSecondSq) etalAccel.vi ints.vi public List <trajectoryconstraint> getConstraints() public double getEndVelocity() can use cluster unpack</trajectoryconstraint>	Progra
TRAJECTORY CONFIG	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 X X X X X X X X X			Execution Test Routi	VI Name TrajectoryConfig_AddConstrai TrajectoryConfig_AddConstrai TrajectoryConfig_Create.vi TrajectoryConfig_GetCentripet TrajectoryConfig_GetConstrair TrajectoryConfig_GetEndVelor TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati	Function Prototype Function Prototype Notes Public TrajectoryConfig addConstraint(TrajectoryConstraint duplicate. Public TrajectoryConfig addConstraints(List extends Implemented differently, can't duplicate. Public TrajectoryConstraint constraints) Public TrajectoryConfig(double maxVelocityMetersPerSecond, double maxAccelerationMetersPerSecondSq) PatalAccel.vi Public List <trajectoryconstraint> getConstraints() Public List<trajectoryconstraint> getConstraints() Public double getEndVelocity() Public double getEndVelocity()</trajectoryconstraint></trajectoryconstraint></trajectoryconstraint></trajectoryconstraint></trajectoryconstraint></trajectoryconstraint>	Progra
TRAJECTORY CONFIG	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 X X X X X X X X X			Execution Test Routi	VI Name TrajectoryConfig_AddConstrai TrajectoryConfig_AddConstrai TrajectoryConfig_Create.vi TrajectoryConfig_GetCentripet TrajectoryConfig_GetConstrair TrajectoryConfig_GetEndVeloc TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati	Function Prototype Public TrajectoryConfig addConstraint(TrajectoryConstraint duplicate. Public TrajectoryConfig addConstraints(List extends trajectoryConstraint) Public TrajectoryConfig addConstraints(List<? extends trajectoryConstraint constraints) Public TrajectoryConfig(double maxVelocityMetersPerSecond, double maxVecelerationMetersPerSecondSq) PatalAccel.vi Public List <trajectoryconstraint> getConstraints() Public List<trajectoryconstraint> getConstraints() Public List<trajectoryconstraint> getConstraints() Public List<trajectoryconstraint> getConstraints() Public List<trajectoryconstraint> getConstraints() Public double getEndVelocity() Can use cluster unpack Public SwerveDrive.vi Public double getEndVelocity()</trajectoryconstraint></trajectoryconstraint></trajectoryconstraint></trajectoryconstraint></trajectoryconstraint>	Progra
TRAJECTORY CONFIG	X	X			Execution Test Routi	VI Name TrajectoryConfig_AddConstrai TrajectoryConfig_AddConstrai TrajectoryConfig_Create.vi TrajectoryConfig_GetCentripet TrajectoryConfig_GetConstrair TrajectoryConfig_GetEndVeloc TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati TrajectoryConfig_GetMaxVelA	Function Prototype Public TrajectoryConfig addConstraint(TrajectoryConstraint constraint) Implemented differently, can't duplicate. Implemented differe	Progra
TRAJECTORY CONFIG	X	X			Execution Test Routi	VI Name TrajectoryConfig_AddConstrai TrajectoryConfig_AddConstrai TrajectoryConfig_Create.vi TrajectoryConfig_GetCentripet TrajectoryConfig_GetConstrair TrajectoryConfig_GetEndVeloc TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati	Function Prototype Function Prototype public TrajectoryConfig addConstraint(TrajectoryConstraint duplicate. Implemented differently, can't duplicate. Implemented differently. Implemented diffe	Progra
TRAJECTORY CONFIG	X	X			Execution Test Routi	VI Name TrajectoryConfig_AddConstrai TrajectoryConfig_AddConstrai TrajectoryConfig_Create.vi TrajectoryConfig_GetCentripet TrajectoryConfig_GetConstrair TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati TrajectoryConfig_GetMaxVeIA TrajectoryConfig_GetStartVeIc TrajectoryConfig_GetStartVeIc TrajectoryConfig_GetStartVeIc TrajectoryConfig_GetVoltageD	Function Prototype Function Prototype Solution Prototype Public TrajectoryConfig addConstraint(TrajectoryConstraint) Constraint) public TrajectoryConfig addConstraints(List extends TrajectoryConstraint onstraints) public TrajectoryConfig(double maxVelocityMetersPerSecond, double maxAccelerationMetersPerSecondSq) public List <trajectoryconstraint> getConstraints() public List<trajectoryconstraint> getConstraints() public double getEndVelocity() can use cluster unpack liticsMecranumfDrive.vi liticsMecranumfDrive.vi liticsSwerveDrive.vi Accel.vi public double getStartVelocity() can use cluster unpack</trajectoryconstraint></trajectoryconstraint>	Progra
TRAJECTORY CONFIG	X	X			29 Execution	VI Name TrajectoryConfig_AddConstrai TrajectoryConfig_AddConstrai TrajectoryConfig_Create.vi TrajectoryConfig_GetCentripet TrajectoryConfig_GetConstrair TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati TrajectoryConfig_GetMaxVelA TrajectoryConfig_GetStartVelC TrajectoryConfig_GetStartVelC TrajectoryConfig_GetVoltageD TrajectoryConfig_IsReversed.v	Function Prototype Function Prototype Space of the public TrajectoryConfig addConstraint(TrajectoryConstraint constraint) public TrajectoryConfig addConstraints(List extends</td <td>Progra</td>	Progra
TRAJECTORY CONFIG	X	X			Execution Test Routi	VI Name TrajectoryConfig_AddConstrai TrajectoryConfig_AddConstrai TrajectoryConfig_Create.vi TrajectoryConfig_GetCentripet TrajectoryConfig_GetConstrair TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati TrajectoryConfig_GetMaxVeIA TrajectoryConfig_GetStartVeIc TrajectoryConfig_GetStartVeIc TrajectoryConfig_GetStartVeIc TrajectoryConfig_GetVoltageD	Function Prototype Public TrajectoryConfig addConstraint(TrajectoryConstraint duplicate. public TrajectoryConfig addConstraints(List extends public TrajectoryConfig addConstraints(List<? extends public TrajectoryConstraint constraints public TrajectoryConfig(double maxVelocityMetersPerSecond, double maxAccelerationMetersPerSecondSq) public TrajectoryConstraint> getConstraints() public List <trajectoryconstraint> getConstraints() public double getEndVelocity() can use cluster unpack iticsMeraumtDrive.vi iticsSwerveDrive.vi Accel.vi public double getStartVelocity() can use cluster unpack public double getStartVelocity() can use cluster unpack public double getStartVelocity() can use cluster unpack public on use cluster unpack public frajectoryConfig setEndVelocity(double</trajectoryconstraint>	Progra
TRAJECTORY CONFIG	X	X	X		29 Execution	VI Name TrajectoryConfig_AddConstrai TrajectoryConfig_AddConstrai TrajectoryConfig_Create.vi TrajectoryConfig_GetCentripet TrajectoryConfig_GetConstrair TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati TrajectoryConfig_GetKinemati TrajectoryConfig_GetStartVelc TrajectoryConfig_GetStartVelc TrajectoryConfig_GetStartVelc TrajectoryConfig_GetVoltageD TrajectoryConfig_setCentripeta	Function Prototype public TrajectoryConfig addConstraint(TrajectoryConstraint duplicate. public TrajectoryConfig addConstraint(TrajectoryConstraint duplicate. public TrajectoryConfig addConstraints(List extends Implemented differently, can't duplicate. public TrajectoryConfig(double maxVelocityMetersPerSecond, double maxAccelerationMetersPerSecondSq) stalAccel.vi public List<TrajectoryConstraint getConstraints() public List <trajectoryconstraint> getConstraints() public double getEndVelocity() can use cluster unpack iticsSMecanumfDrive.vi public double getEndVelocity() can use cluster unpack iticsSwerveDrive.vi public double getStartVelocity() can use cluster unpack iticsSwerveDrive.vi public double getStartVelocity() can use cluster unpack iticsSwerveDrive.vi public double getStartVelocity() can use cluster unpack iticsSwerveDrive.vi public TrajectoryConfig setEndVelocity(double endVelocity(double endVelocityMetersPerSecond)</trajectoryconstraint>	Progra

Revision 3.05 3/01/2023 – Added execute routines for state space sim and ctrl TrajectoryConfig setKinematicsSwerveDrive.vi public TrajectoryConfig setKinematics(SwerveDriveKinematics SI kinematics) XX X SI public TrajectoryConfig setReversed(boolean reversed) TrajectoryConfig_setReversed.vi public TrajectoryConfig setStartVelocity(double XX Χ TrajectoryConfig_SetStartVelocity.vi startVelocityMetersPerSecond) X X X X SI TrajectoryConfig_setVoltageDiffDrive.vi 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. Function Prototype TRAJECTORY GENERATE X public static Trajectory generateTrajectory(Spline.ControlVector uses cubic splines TrajectoryGenerate_Make_Cubic_CtrlVect.vi initial, List<Translation2d> interiorWaypoints, Spline.ControlVector end, TrajectoryConfig config)

public static Trajectory generateTrajectory(Pose2d start, List<Translation2d> interiorWaypoints, Pose2d end, $X \mid X$ X TrajectoryGenerate Make Cubic.vi uses cubic splines TrajectoryConfig config) TrajectoryGenerate Make Generic.vi Helper to bring these all together.. $X \mid X$ $X \mid X$ Use this one!!! public static Trajectory generateTrajectory(ControlVectorList controlVectors, TrajectoryConfig config) TrajectoryGenerate_Make_Quintic_CtrlVect.vi Χ uses quintic splines X TrajectoryGenerate_Make_Quintic_Weighted.vi New 2762 $X \mid X$ $X \mid X$ public static Trajectory generateTrajectory(List<Pose2d> waypoints, TrajectoryConfig config) TrajectoryGenerate Make Quintic.vi X uses quintic splines X Χ TrajectoryGenerate splinePointsFromSplines.vi public static List<PoseWithCurvature> X Χ splinePointsFromSplines(Spline[] splines) VI Name Function Prototype Notes public ControlVectorList(int initialCapacity) TRAJECTORY GENERATE (Control Vector) may not need, just data public ControlVectorList() may not need, just data public ControlVectorList(Collection<? extends may not need, just data Spline.ControlVector> collection) Function Prototype Notes TRAJECTORY PARAMETERIZE X TrajectoryParam calcStuffFwd.vi Χ X No Χ X No TrajectoryParam calcStuffRev.vi private static void enforceAccelerationLimits(boolean reverse, TrajectoryParam enforceAccel.vi Χ his routines needs to be changed List<TrajectoryConstraint> constraints, ConstrainedState state) vhen new constraints are added. X TrajectoryParam enforceVelocity.vi This routines needs to be changed TrajectoryParam timeParam.vi public static Trajectory X timeParameterizeTrajectory(List<PoseWithCurvature> points. List<TrajectoryConstraint> constraints, double startVelocityMetersPerSecond, double endVelocityMetersPerSecond, double maxVelocityMetersPerSecond, double maxAccelerationMetersPerSecondSq. boolean reversed)

/2023 – Added execute routines for state spa	ace si	m and	CITI						
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					Execution Optimized		•		
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	mplementea	Documented	WPILIB	Menu Item	on	Test Routine	Sample Program		
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			Ž		<u> </u>	_ <u>~</u>		Function Prototype	Notes
DIFF DRIVE KINEMATIC CONSTRAINT	X	X		X			DiffDriveKinematicsConstraint_getMaxVelocity.vi	public double getMaxVelocityMetersPerSecond(Pose2d	
								poseMeters, double curvatureRadPerMeter, double velocityMetersPerSecond)	
	X	X		X			DiffDriveKinematicsConstraint_getMinMaxAccel.vi	public MinMax	
	^	_ ^		^			Dilibriverinematics constraint_getivililiviaxAccel.vi	getMinMaxAccelerationMetersPerSecondSg(Pose2d poseMeters	
								getMinMaxAccelerationMetersPerSecondSq(Pose2d poseMeters, double curvatureRadPerMeter, double velocityMetersPerSecond)	
	X	X		X	SI		DiffDriveKinematicsConstraint_New.vi	public DifferentialDriveKinematicsConstraint(final	
								DifferentialDriveKinematics kinematics, double	
								maxSpeedMetersPerSecond)	
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	mplemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	Function Prototype	Notes
DIFF DRIVE VOLTAGE CONSTRAINT	_	X	_ <	_ ≥	Щ			public double getMaxVelocityMetersPerSecond(Pose2d	110163
DIFF DRIVE VOLTAGE CONSTRAINT	٨	^		^			Dilibrive voltageConstraint_getwaxvelocity.vi	public double getiviaxivelocityivietersPerSecond(Posezd poseMeters, double curvatureRadPerMeter, double	
								velocityMetersPerSecond)	
	X	X		X			DiffDriveVoltageConstraint_getMinMaxAccel.vi	public MinMax	
	•	``		^`				getMinMaxAccelerationMetersPerSecondSq(Pose2d poseMeters,	
								double curvatureRadPerMeter, double velocityMetersPerSecond)	
_									
	X	X		X	SI		DiffDriveVoltageConstraint_New.vi	public	
								DifferentialDriveVoltageConstraint(SimpleMotorFeedforward feedforward, DifferentialDriveKinematics kinematics, double	
								feedforward, DifferentialDriveKinematics kinematics, double	
L								maxVoltage)	
					Ø				
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	ше	<i>a</i> e	ď	#	ıtic	8	e/s		
	Implemented	n	Not WPILIB	nu	Execution Optimized	Test Routine	Sample Program		
	Ē	Documented	Ş	Menu Item	Ř	je j	[®] VI Name	Function Prototype	Notes
ELLIPTICAL REGION CONSTRAINT	Χ	Χ		Χ			EllipRegionConstraint_getMaxVelocity.vi		
	Χ	Χ		Χ			EllipRegionConstraint_getMinMaxAccel.vi		
	X	X		X			EllipRegionConstraint IsPoseInRegion.vi		
	Χ	Χ		Χ			EllipRegionConstraint_New.vi		
L				-					
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					ijŹĘ		2		
					Execution Optimized		'a'		
	pə.	eq	В	_	Ó	ne 1	Sample Progr		
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	ŭ	ŭ	₹	#	ntic	B	e/c		
	Implementea	Documented	*	Menu Item	ec	Test Routine	K		
		۵	Not	Ž	Щ	e			Notes
JERK CONSTRAINT	/		X				JerkConstraint_getMaxVelocity.vi		FUTURE
							JerkConstraint_getMinMaxAccel.vi	Routine exists, it is just a shell	FUTURE
	/		X				ochoonstant_getiiniiiaa tooti.vi		
	/		X		SI		JerkConstraint New.vi	Routine exists, it is just a shell	FUTURE
	/				SI			Routine exists, it is just a shell	FUTURE
	/							Routine exists, it is just a shell	FUTURE
	/						JerkConstraint_New.vi	Routine exists, it is just a shell	FUTURE
	/						JerkConstraint_New.vi	Routine exists, it is just a shell	FUTURE
	// 	pə		_		eu.	JerkConstraint_New.vi	Routine exists, it is just a shell	FUTURE
) led	ented	X	me		utine	JerkConstraint_New.vi	Routine exists, it is just a shell	FUTURE
	/ /	mented	X	ı Item		Routine	JerkConstraint_New.vi	Routine exists, it is just a shell	FUTURE
	\	ocumented	X	anu Item		st Routine	JerkConstraint_New.vi	Routine exists, it is just a shell	FUTURE
	Implemented \	Documented		Menu Item	Execution Optimized	Test Routine	JerkConstraint_New.vi	Routine exists, it is just a shell	FUTURE Notes
MAX VELOCITY CONSTRAINT	Χ	Χ	X	Χ	প্ৰ Execution Optimized	Test Routine	JerkConstraint_New.vi	Routine exists, it is just a shell	FUTURE
MAX VELOCITY CONSTRAINT		X	X	X	ଓ ଓ Execution Optimized	Test Routine	JerkConstraint_New.vi	Routine exists, it is just a shell	FUTURE
MAX VELOCITY CONSTRAINT	Χ	Χ	X	Χ	প্ৰ Execution Optimized	Test Routine	JerkConstraint_New.vi	Routine exists, it is just a shell	FUTURE
MAX VELOCITY CONSTRAINT	X	X	X	X	ଓ ଓ Execution Optimized	Test Routine	JerkConstraint_New.vi	Routine exists, it is just a shell	FUTURE

Implemented Documented Not WPILIB Menu Item	Execution Optimi Test Routine Sample Program	VI Name	Function Prototype	Notes
TRAJECTORY CONSTRAINT (Min Max) X X X		Constraint_MinMax_New.vi	Constraint_MinMax_New	
X X X	SI	Constraint_MinMax_NewMinMax.VI	Constraint_MinMax_New	

'======== UTILITY

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

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	Implemented	Documented	Not WPILIB	Menu Item	Execution	Test Routine	Sample Program	VI Name	Function Prototype	Notes
UTIL	Χ	Χ	Χ	Χ	SI			Util_ApproxEqual.vi		
	Χ	Χ	Χ	Χ				Util_Array_PoseWCurv_to_XY.vi		
	Χ	Χ	Χ	Χ	SI			Util_CalcDist.vi		
	Χ	Χ	Χ	Χ	SI			Util_GetLibraryVersion.vi		
	Χ	Χ	Χ	Χ	SI			Util_GetLibUsage.vi		
	Χ	X	X	X				Util_GetTime.vi		Once tested completely, this should be optimized!
	Χ	Χ	Χ	No	- 1			Util_GetTime_U32.vi		
	Χ	Χ	Χ	No	1			Util_GetTime_U64.vi		
	Χ	Χ	Χ	No	N/A			Util_LibraryGlobals.vi		Global Variables – no block diag.
	Χ	Χ	Χ	Χ				Util_Trajectory_Absolute_To_Relative.vi		
	Χ	Χ	Χ	Χ				Util_Trajectory_ReadFile.vi		
	Χ	Χ	Χ	Χ				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	Χ				Util_Trajectory_WriteFile_PathFinder.vi		
	Χ	Χ	Χ	No				Util_Trajectory_WriteFile_PathFinderConfig.vi		internal
	Χ	Χ	Χ	Χ				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	Χ				Util_Trajectory_WriteFile.vi		
	Χ	Χ	Χ	Χ				Util_TrajectoryState_Meters_To_Inches.vi		
	Χ	Χ	Χ	Χ				Util_TrajState_to_DiffDrive_WheelPos.vi		
	Χ	Χ	Χ	Χ				Util_DispWaypoint_Eng_To_SI.vi		
	Χ	Χ	Χ	Χ				Util_DispWaypoint_To_CubicInput.vi		
	Χ	Χ	Χ	Χ				Util_DispWaypoint_To_QuinticInput.vi		
	Χ	Χ	Χ	Χ				Util_DispWeightedWaypiont_Eng_To_WeightedWaypoint		
	Χ	X	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 Optimized	Test Routine	Sample Program		Function Prototype	Notes
CONV	Χ	Χ	Χ	Χ	SI			Conv_AngleDegrees_Heading.vi		
	X	Χ	Χ	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	Χ	Χ	SI			Conv_Deg_Rotations.vi		
	Χ	Χ	Χ	Χ	SI			Conv_Feet_Meters.vi		
	Χ	Χ	Χ	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	Χ	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		
	Χ	Χ	X	X	SI			Conv_Yards_Meters.vi		

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state spa	lemented	sumented g	WPILIB	nu Item	Execution Optimized	t Routine	nple Program			
	Imp	Ď	Not	Menu	Ĕ	Test	Sai	VI Name	Function Prototype	Notes
UNITS	Χ	Χ		X	SI			Units_DegreesToRadians.vi		
	Χ	Χ		X	SI			Units_DegreesToRotations.vi		
	Χ	Χ		X	SI			Units_FeetToMeters.vi		
	Χ	Χ		X	SI			Units_InchesToMeters.vi		
	Χ	Χ		X	SI			Units_MetersToFeet.vi		
	Χ	Χ		X	SI			Units_MetersToInches.vi		
	Χ	Χ		X	SI			Units_MillisecondsToSeconds.vi		
	Χ	Χ		X	SI			Units_RadiansPerSecondToRotationsPerMinute.vi		
	Χ	Χ		X	SI			Units_RadiansToDegrees.vi		
	Χ	Χ		X	SI			Units_RadiansToRotations.vi		
	Χ	Χ		X	SI			Units_RotationsPerMinuteToRadiansPerSecond.vi		
	Χ	Χ		X	SI			Units_RotationsToDegrees.vi		
	Χ	Χ		X	SI			Units_RotationsToRadians.vi		
	Χ	X		X	SI			Units_SecondsToMilliseconds.vi		

'======== PATHFINDER UTIL

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	Function Prototype	Notes
PATHFINDERUTIL	Χ	Χ	Χ	Χ			PathfinderUtil_Continuous_Heading_Difference.vi		
	Χ	Χ	Χ	Χ			PathfinderUtil_OptimizeTrajectoryStates.vi		
	Χ	Χ	Χ	Χ			PathfinderUtil_ToTrajectory.vi		
	Χ	X	X	X			PathfinderUtil_ToTrajectoryStates.vi		

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

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program Namel		Function Prototype	١	Notes	Code Review	Test Program	Error Checking	х
DC MOTOR		X		X	SI			or_GetAndymark9015.vi							Х
	Χ	X			SI			or_GetAndymarkAM2235A.vi							Х
	Χ	X		X	SI			or_GetAndymarkAM3493.vi							Х
	Χ	X		X	SI			or_GetAndymarkRs775_125.vi							Х
	Χ	X			SI		DCMoto	or_GetBag.vi							Х
	Χ	X		Χ	SI			r_GetBanebotsRs550.vi							Х
	Χ	X		X	SI			or_GetBanebotsRs775.vi							Х
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Revision 3.05

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3/01/2023 – Added execute routines for state												
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	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	Function Prototype	Notes	Code Review	Test Program	Error Checking
UNSCENTED KALMAN FILTER	Χ	X		X			UnscentedKalmanFilter_Correct_FuncGroup.vi					
	X	X		Χ			UnscentedKalmanFilter_Correct_OnlyUY.vi					
	X	X		Χ			UnscentedKalmanFilter_Correct_OnlyUYR.vi					
	X	X		X			UnscentedKalmanFilter_Correct.vi					
	Χ	X		X			UnscentedKalmanFilter_GetP_Single.vi					
	Χ	X		X			UnscentedKalmanFilter_GetP.vi					
	X	X		X			UnscentedKalmanFilter_GetXHat_Single.vi					
	Χ	X		X			UnscentedKalmanFilter_GetXHat.vi					
	X	X		X			UnscentedKalmanFilter_New_Default.vi					
	Χ	X		X			UnscentedKalmanFilter_New_FuncGroup.vi					
	Χ	X		X			UnscentedKalmanFilter_New.vi					
	X	X		X			UnscentedKalmanFilter_Predict.vi					
	X	X		X			UnscentedKalmanFilter_Reset.vi					
	X	X		X			UnscentedKalmanFilter_SetP.vi					
	X	X		X			UnscentedKalmanFilter_SetXHat_Single.vi					
	X	X		X			UnscentedKalmanFilter_SetXHat.vi					
	X	X		X			UnscentedKalmanFilter_Transform.vi					

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

CONTROL AFFINE PLANT INVERSION FEEDFORWARD	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Name VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	Function Prototype	Notes	Code Review	Test Program	Error Checking
DIFFERENTIAL DRIVE ACCELERATION LIMITER	X	X		X		X	DiffDrvAccelLimit_Calculate.vi DiffDrvAccelLimit_New.vi					
	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Nample Program	Function Prototype	Notes	Code Review	Test Program	Error Checking
IMPLICIT MODEL FOLLOWER	X	X		Χ		Χ	ImplModelFollow_Calculate.vi					
	X	X X X		X		Χ	ImplModelFollow_GetU.vi					
	X	X		X		X	ImplModelFollow_GetU_Single.vi					
	X	X		X		X	ImplModelFollow_New.vi ImplModelFollow_New_Plant.vi					
		X		X		X	ImplModelFollow_New_Plant.vi					
	_^	<u> </u>		1		^	IIII PIINIOGOII OIIOW_IXESEL.VI					

	ited	ted	118	=	ı Optimize	ine				/iew	ıram	
	nplemen	ocumen	Vot WPILIB	Menu Item	Execution	Test Routine		5 5		Code Rev	Test Progr	
LINEAR PLANT INVERSION FEEDFORWARD	_ <u>=</u>	X		X	Ŵ	<u>~ ~ (</u>	VI Name LinearPIntInvFF Calculate NextR.vi	Function Prototype	Notes	<u>o</u>	_ 	$\overline{}$
LINEAR FEART INVERSION I LEDI ORWARD	X			X			Linear Intilivi F Calculate.vi			-+		+
	X	X		X			LinearPIntInvFF_GetR_Single.vi					
	Χ			X			LinearPIntInvFF_GetR.vi					I
	X			X			LinearPIntInvFF_GetUff_Single.vi			\longrightarrow		₩
	X			X X			LinearPIntInvFF_GetUff.vi LinearPIntInvFF New Plant.vi			-+		+
	X	X		X			LinearPIntInvFF New.vi			-+		+
	X			X			LinearPIntInvFF_Reset_Initial.vi					+
	X	X		Χ			LinearPIntInvFF_Reset_Zero.vi					
					eq							
					timiz							
	pə;	pə.	В	~	õ	ne ne				iew	'am	
	ieni	ent	WPILIB	ten	Execution	Routine			ſ	Zev.	Progi	
	len	unc	Š	Menu Iten	cat				-	de F	7. D	
	Ш	Doc	Not	Me	Ě	Test	VI Name	Function Prototype	Notes	Ö	Test	
LINEAR QUADRATIC REGULATOR		X		X			LinearQuadraticRegulator_Calculate_NextR.vi					
	X	X		X			LinearQuadraticRegulator_Calculate.vi		NOT OBJORNA	\longrightarrow		_
	X	X		X X		X	LinearQuadraticRegulator_GetK_Single.vi LinearQuadraticRegulator_GetK.vi		NOT ORIGINAL	-+		+
	X	X		X		^	LinearQuadraticRegulator_GetR_Single.vi			\rightarrow		+
	X			Χ			LinearQuadraticRegulator_GetR.vi			$\overline{}$		\top
	X	X		X			LinearQuadraticRegulator_GetU_Single.vi					
	X			X			LinearQuadraticRegulator_GetU.vi					
	X	X		X		X	LinearQuadraticRegulator_LatencyCompensate.vi		Routine exists, but it only has interger raise matrix to power.			
	X	X		Χ			LinearQuadraticRegulator_New_ELMS.vi					I
	Χ	X		X			LinearQuadraticRegulator_New_N.vi LinearQuadraticRegulator_New_Raw.vi			\rightarrow		+
	X	Х		X		x	LinearQuadraticRegulator_New_SystemELMS.vi			\rightarrow		+
	X	X		X			LinearQuadraticRegulator_New.vi			-+		1
	X	X		Χ			LinearQuadraticRegulator_Reset.vi					
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	oler	cnu	<i>*</i>	nu	ecn	St F			•	de	st P	
	#	8	-8	₩ We	й	ě d		Function Prototype	Notes	Cod		
LINEAR SYSTEM				X	1		LinearSystem_CalculateX.vi			\longrightarrow		+
	X	X		X X			LinearSystem_CalculateY.vi LinearSystem GetA.vi			-+		+
	X	X		X		-	LinearSystem_GetA.vi LinearSystem_GetAElement.vi			-+		+
	X			X	SI		LinearSystem_GetB.vi			-+		\dagger
	X	X		X .	SI		LinearSystem_GetBElement.vi					Ι
	X			X .			LinearSystem_GetC.vi			\Box		\perp
	X			X .		_	LinearSystem_GetCElement.vi			\longrightarrow		+
	X			X .			LinearSystem_GetD.vi LinearSystem GetDElement.vi			\longrightarrow		+
		X		X .			LinearSystem_Gerbeinent.vi			+		+
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	nented	nented	PILIB		Execution Optimized Test Routine Sample Program				Review	Program	:
	Implen		Not WPILIB		Execut Test R	VI Name	Function Prototype	Notes	Code F	Test PI	ı
LINEAR SYSTEM LOOP			X			LinearSystemLoop_ClampInput.vi					\perp
	X		X			LinearSystemLoop_Correct.vi LinearSystemLoop_DCMotor_Execute.vi					+
	X	$\frac{\lambda}{Y}$	X X X X	, (SI .	LinearSystemLoop_DCMotor_Execute.vi					+
			XX		,	LinearSystemLoop DiffDrv Execute.vi			-		+
	Χ	X	XX	′ 5	SI	LinearSystemLoop_DiffDrv_Pack_Ctrl.vi					
	Χ	X	XX			LinearSystemLoop_Elevator_Execute.vi					
	X	X	X X		6/	LinearSystemLoop_Elevator_Pack_Ctrl.vi					—
	X	X	XX			LinearSystemLoop_Execute.vi					+
			X X X X		21	LinearSystemLoop_FlyWheel_Execute.vi LinearSystemLoop_FlyWheel_Pack_Ctrl.vi					+
	^)	LinearSystemLoop_GetClampFunction.vi					+
	Х	Х	X			LinearSystemLoop GetController.vi					_
		Х	Х			LinearSystemLoop_GetError_Single.vi					
			X			LinearSystemLoop_GetError.vi					
		Χ	X			LinearSystemLoop_GetFeedForward.vi					↓
	X	X	X			LinearSystemLoop_GetNextR_Single.vi					
	X	X	X			LinearSystemLoop_GetNextR.vi LinearSystemLoop_GetObserver.vi					+
			$\frac{1}{x}$			LinearSystemLoop_GetObserver.vi					+
			X			LinearSystemLoop_GetU.vi					
	Χ	X	Х			LinearSystemLoop_GetXHat_Single.vi					
	Χ	Χ	X			LinearSystemLoop_GetXHat.vi					
						LinearSystemLoop_New_BBB					
				,		LinearSystemLoop_New_LinearSystem_ClampFunc					+
	X	X	X			LinearSystemLoop_New_LinearSystem_ClampVal.vi LinearSystemLoop_New.vi					+
		X		′ 5	SI	LinearSystemLoop_New.vi					+
			X			LinearSystemLoop_Predict.vi					+
			X			LinearSystemLoop Reset.vi					
						LinearSystemLoop_SetClampFunction.vi					
		-				LinearSystemLoop_SetNextR_Some.vi					
	Χ	X	X			LinearSystemLoop_SetNextR.vi					+
		-+				LinearSystemLoop_SetXHat_Single.vi LinearSystemLoop_SetXHat.vi					+
	Х	X	X X	,		LinearSystemLoop_SngJntArm_Execute.vi					+
	X	X	$X \mid X$	′ 5	SI	LinearSystemLoop SngJntArm Pack Ctrl.VI			-		+
						, , , , , , , , , , , , , , , , , , , ,					
	K	X	X X X X X X X X X X X X X X X X X X X		Routine ple Program	LinearSystemLoop_SngJntArm_Pack_Ctrl.VI			e Review	t Program	
	шb	200	Not W		exec rest Sam	VI Name	Function Prototype	Notes	00	Zes.	ı
LTV DIFFERENTIAL DRIVE CONTROLLER	X	X			<u> </u>	LTVDiffDriveCtrl_AtReference.vi	yr-				Т.
			X			LTVDiffDriveCtrl_Calculate_TrajState.vi					
			X			LTVDiffDriveCtrl_Calculate.vi					\perp
	X	X	XX			LTVDiffDriveCtrl_Execute_TrajState.vi					+
			XX			LTVDiffDriveCtrl_Execute.vi					+
			X X		SI I	LTVDiffDriveCtrl_New.vi LTVDiffDriveCtrl_Pack_Ctrl_Params.vi					+
						LIVE INCOMITACK ON TAIMING.VI	1				+
									1		
	Χ	Χ	X X X	′ 5	SI	LTVDiffDriveCtrl Pack Model Params.vi LTVDiffDriveCtrl Pack Tolerance.vi					

Revision 3.05 3/01/2023 – Added execute routines for state space sim and ctrl Function Prototype Notes LTV UNICYCLE CONTROLLER X X LTVUnicycleCtrl_AtReference.vi X SI X $X \mid X$ X X LTVUnicycleCtrl_Calculate_TrajState.vi LTVUnicycleCtrl Calculate.vi $X \mid X \mid$ X LTVUnicycleCtrl_Execute.vi X X X X LTVUnicycleCtrl Execute TrajState.vi LTVUnicycleCtrl New.vi X X X X SI LTVUnicycleCtrl_Pack_Model_Params.vi LTVUnicycleCtrl_Pack_Tolerance.vi X X X X SI LTVUnicycleCtrl_SetEnabled.vi X SI X X SI X LTVUnicycleCtrl SetTolerance.vi '======= STATE SPACE UTILITIES '======== Function Prototype Notes CALLBACK HELPER X X XX CallbackHelp MatrixMinus.vi X X X X CallbackHelp MatrixMult CoerceSizeB.vi CallbackHelp_MatrixMult.vi $X \mid X \mid X \mid X$ CallbackHelp MatrixPlus.vi X X X X Function Prototype Notes DISCRETIZATION X X Discretization_DiscretizeA.vi XX Χ Χ Discretization DiscretizeAB.vi Discretization DiscretizeABTaylor.vi $X \mid X$ Χ X XX Discretization DiscretizeAQ.vi X X XX Discretization DiscretizeAQTaylor.vi Χ Χ Discretization_DiscretizeR.vi Function Prototype Notes STATE SPACE UTIL X X X No StateSpaceUtil Check Stabalizable.vi Internal routine StateSpaceUtil_ClampInputMaxMagnitude.vi X Routine exists, it is just a shell $X \mid X$ XX Χ StateSpaceUtil_IsDetectable.vi X X X X X StateSpaceUtil IsStabalizable.vi StateSpaceUtil MakeCostMatrix.vi StateSpaceUtil MakeCovarianceMatrix.vi XX X Χ StateSpaceUtil MakeWhiteNoiseVector.vi $X \mid X$ X XX StateSpaceUtil NomalizeInputVector.vi X StateSpaceUtil PoseTo3dVector.vi X StateSpaceUtil_PoseTo4dVector.vi XX Х StateSpaceUtil PoseToVector.vi XX Х

Revision 3.05 3/01/2023 – Added execute routines for state space sim and ctrl

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SIMULATION '======== Function Prototype BatterySim CalculateDefaultBatteryLoadedVoltage.vi BATTERY SIM X X X SI XX X SI BatterySim CalculateLoadedVoltage.vi X X X X SI BatterySim Execute.vi Function Prototype Notes DC MOTOR SIM X X DCMotorSim_Execute.vi X DCMotorSim_getAngularPositionRad.vi Χ DCMotorSim getAngularPositionRotations.vi XX X DCMotorSim getAngularVelocityRadPerSec.vi XX X DCMotorSim_getAngularVelocityRPM.vi DCMotorSim GetCurrentDrawAmps.vi XX X DCMotorSim New MOI.vi XX Χ X X X X X X SI DCMotorSim New Plant.vi DCMotorSim_Pack_Simulation_Params.vi XX X DCMotorSim SetInputVoltage.vi DCMotorSim Update.vi $X \mid X$ Χ VI Name Notes Function Prototype DIFFERENTIAL DRIVE TRAIN SIM X DiffDriveTrainSim ClampInput.vi Χ DiffDriveTrainSim_CreateKitbotSim_EstMass.vi XX Χ DiffDriveTrainSim CreateKitbotSim EstMassMOI.vi XX X DiffDriveTrainSim CreateKitbotSim.vi DiffDriveTrainSim Execute.vi $X \mid X \mid X \mid X$ XX DiffDriveTrainSim GetCurrentDrawAmps.vi X DiffDriveTrainSim_GetCurrentGearing.vi XX X X DiffDriveTrainSim_GetDynamics.vi DiffDriveTrainSim_GetHeading.vi XX Х DiffDriveTrainSim_GetLeftCurrentDrawAmps.vi XX Χ XX DiffDriveTrainSim_GetLeftPositionMeters.vi Χ XX DiffDriveTrainSim GetLeftVelocityMetersPerSecond.vi X DiffDriveTrainSim_GetOutput_Single.vi XX Χ DiffDriveTrainSim_GetPose.vi XX Χ DiffDriveTrainSim_GetRightCurrentDrawAmps.vi DiffDriveTrainSim_GetRightPositionMeters.vi XX X DiffDriveTrainSim_GetRightVelocityMetersPerSecond.vi X DiffDriveTrainSim GetState Single.vi XX X DiffDriveTrainSim_GetState.vi X XX X DiffDriveTrainSim KitBotWheelSize.vi DiffDriveTrainSim New Mass MOI.vi $X \mid X$ Χ DiffDriveTrainSim New.vi XX X XX DiffDriveTrainSim Pack Model Params.vi X X X DiffDriveTrainSim Pack Simulation Params.vi XX DiffDriveTrainSim_SetCurrentGearing.vi XX X DiffDriveTrainSim SetInputs.vi $X \mid X \mid$ X DiffDriveTrainSim SetPose.vi

Revision 3.05 3/01/2023 – Added execute routines for state space sim and ctrl XX DiffDriveTrainSim SetState.vi XX Χ DiffDriveTrainSim_ToughBoxMiniGearRatio.vi XX DiffDriveTrainSim_ToughBoxMiniMotor.vi Χ Χ DiffDriveTrainSim Update.vi VI Name Function Prototype Notes ELEVATOR SIM X X X X ElevatorSim Execute.vi XX ElevatorSim GetCurrentDraw.vi ElevatorSim_GetPositionMeters.vi XX X X ElevatorSim GetVelocityMetersPerSecond.vi X X ElevatorSim_HasHitLowerLimit.vi XX X ElevatorSim HasHitUpperLimit.vi ElevatorSim New LinSys NoNoise.vi ElevatorSim_New_LinSys.vi ElevatorSim New NoNoise.vi ElevatorSim New.vi X X X X SI ElevatorSim Pack Simulation Params.vi ElevatorSim_RKF45_Func.vi X X X No ElevatorSim_SetInputVoltage.vi X X X ElevatorSim SetState.vi X X X X ElevatorSim Update.vi Needed because this doesn't ElevatorSim UpdateX.vi Χ X XX ElevatorSim WouldHitLowerLimit.vi XX ElevatorSim WouldHitUpperLimit.vi Function Prototype Notes FLYWHEEL SIM X X $X \mid X$ FlyWheelSim Execute.vi FlyWheelSim_GetAngularVelocityRadPerSec.vi XX Χ X FlyWheelSim GetAngularVelocityRPM.vi X X X FlyWheelSim_GetCurrentDrawAmps FlyWheelSim New LinSys Future FlyWheelSim New LinSys MOI NoNoise Future FlyWheelSim_New_LinSys_NoNoise Future X X X X X SI X X FlyWheelSim New MOI.vi FlyWheelSim Pack Simulation Params.vi XX X FlyWheelSim SetInput.vi XX X FlyWheelSim SetState.vi FlyWheelSim_Update.vi XX Χ Function Prototype VI Name Notes LINEAR SYSTEM SIM X X X X LinearSystemSim ClampInput.vi X LinearSystemSim Execute.vi LinearSystemSim GetCurrentDrawAmps.vi DONT IMPLEMENT. $X \mid X$ X LinearSystemSim GetOutput Single.vi XX LinearSystemSim_GetOutput.vi X XX X LinearSystemSim New LinearSystemSim New NoNoise.vi X X Χ LinearSystemSim_SetInput_Array.vi Doesn't use clamp? XX Χ LinearSystemSim SetInput Single.vi LinearSystemSim_SetInput.vi XX X

Revision 3.05 3/01/2023 – Added execute routines for state space sim and ctrl XX LinearSystemSim Setstate.vi XX X LinearSystemSim_Update.vi XX LinearSystemSim UpdateX.vi No X X X No LinearSystemSim UpdateY.vi Function Prototype SINGLE JOINT ARM SIM X SngJntArmSim EsitmateMOI.vi X X X X SngJntArmSim Execute.vi SngJntArmSim_GetAngleRads.vi XX X SngJntArmSim_GetCurrentDraw.vi XX X X X X X Χ SngJntArmSim_GetVelocityRadsPerSec.vi SngJntArmSim HasHitLowerLimit.vi XX Χ SngJntArmSim_HasHitUpperLimit.vi XX Х SngJntArmSim New.vi X X X X SI SngJntArmSim Pack Simulation Params.vi SngJntArmSim Rkf45 Func.vi XX No XX Χ SngJntArmSim_SetInputVoltage.vi XX X SngJntArmSim_SetState.vi XX X SngJntArmSim Update.vi XX Χ SngJntArmSim UpdateX.vi SngJntArmSim_WouldHitLowerLimit.vi $X \mid X$ Χ X SngJntArmSim WouldHitUpperLimit.vi '======= MATRIX UTILITIES '======== VI Name Function Prototype Notes MAT BUILDER X X X SI MatBuilder Create.vi XX X SI MatBuilder Fill.vi Function Prototype Notes MATRIX X X Matrix_AssignBlock.vi X SI Matrix Block.vi $X \mid X$ X SI Matrix ChangeBoundsUnchecked.vi XX X SI Matrix Create.vi Matrix Det.vi XX X SI Matrix_Diag.vi Matrix Div Scalar.vi labview has function Matrix_ElementPower.vi XX X SI Matrix ElementSum.vi Matrix ElementTimes.vi Matrix_Equals.vi X X X I X SI Matrix Exp.vi Matrix_ExtractColumnVector.vi XX X SI Matrix ExtractFrom.vi Matrix ExtractMatrix.vi X X Matrix_ExtractRowVector.vi X SI X SI Matrix Fill.vi XX

Matrix Get.vi

Matrix Ident.vi

XX

XI

labview has function

WPILIB calls this EYE

WPILib LabVIEW Math Library – VI Implementation List Revision 3.05 3/01/2023 – Added execute routines for state space sim and ctrl Matrix Inv.vi Matrix_IsEqual.vi X SI Matrix IsIdentical.vi XX Matrix LLTDecompose.vi Matrix Max.vi Matrix MaxAbs.vi Matrix Mean.vi Matrix MinInternal.vi Matrix_Minus_Matrix.vi Matrix Minus Scalar.vi XX X I Matrix NormF.vi Matrix_NormIndP1.vi Matrix Plus Matrix.vi Matrix_Plus_Scalar.vi XX X I Matrix Pow.vi THIS NEEDS WORK!!!! Matrix SetColumn.vi XX X SI THERE ARE LOTS OF OTHER MATRIX FUNCTIONS THAT Matrix_SetRow.vi X SI SHOULD BE INCLUDED HERE FOR ISOLATION. Matrix Solve.vi Matrix_Times_Matrix.vi Matrix Times Scalar.vi Matrix Trace.vi XX X SI Matrix Transpose.vi X X X X Matrix WithinTolerance.vi Function Prototype VI Name Notes SIMPLE MATRIX X X SI SimpleMatrix ExtractMatrix.vi NOTE Matrix also has an ExtractMatrix with different calling parameters.... YUK. Function Prototype Notes MATRIX HELPER X X X X SI MatrixHelper_CooerceSize.vi X X X X SI MatrixHelper MultCooerceBSize.vi X X X X SI MatrixHelper Zero.vi Function Prototype Notes VECTOR BUILDER X X X SI VecBuilder 1x1Fill.vi XX X SI VecBuilder 2x1Fill.vi VecBuilder_3x1Fill.vi XX X SI X SI VecBuilder 4x1Fill.vi XX VecBuilder_5x1Fill.vi XX X SI VecBuilder 6x1Fill.vi XX X SI VecBuilder 7x1Fill.vi

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VecBuilder 8x1Fill.vi

VecBuilder 9x1Fill.vi VecBuilder 10x1Fill.vi VecBuilder_ArrayBy1Fill.vi

WPILib LabVIEW Math Library – VI Implementation List Revision 3.05 3/01/2023 – Added execute routines for state spa	t and otr	-1			_				
VECTOR	Implemented Documented	Menu Item	99 Execution Optimized Test Routine	VI Name Vector_Dot.vi Vector_Norm.vi	Function Prototype	Notes	Code Review	Test Program	x x X X X X X X X X X X X X X X X X X X
'======= MATH '========									X X X
ANGLE STATISTICS	X X Implemented X X X Documented	Z	X Execution Optimized X Test Routine	VI Name AngleStats_AngleAdd_CallbackHelp.vi AngleStats_AngleAdd.vi	Function Prototype	Notes	Code Review	Test Program	Error Checking x x x
	X X X	Υ X X	X I X	AngleStats_AngleMean_CallbackHelp.vi AngleStats_AngleMean.vi					x x x
	X X X	X	I X	AngleStats_AngleResidual_CallbackHelp.vi AngleStats_AngleResidual.vi					x x x
MATH UTILITY	Documented X X X X X X X X X X X X X X X X X X X		SI SI SI	Will Name MathUtil_AngleModulus.vi MathUtil_ApplyDeadband.vi MathUtil_Clamp_Int.vi MathUtil_Clamp.vi MathUtil_InputModulus.vi MathUtil_InputModulus.vi	Function Prototype	Notes	Code Review	Test Program	x x x x x x x x x x x x x x x x x x x
MERWE SCALED SIGMA POINTS	章	X X X X X	SI SI SI I	WerweScSigPts_GetWc_vi MerweScSigPts_GetWc_vi MerweScSigPts_GetWc_vi MerweScSigPts_GetWc_vi MerweScSigPts_GetWr_single.vi MerweScSigPts_GetWm_vi MerweScSigPts_GetWm.vi MerweScSigPts_GetWm.vi	Function Prototype	Notes	Code Review	Test Program	x x x x x x x x x x x x x x x x x x x
	X X X X	X		MerweScSigPts_New.vi MerweScSigPts_SigmaPoints.vi					x x x
	Implemented Documented	Menu Item	Execution Optimized Test Routine	Sample Program	Function Prototype	Notes	Code Review	Test Program	Error Checking x x x

NUMERICAL INTEGRATION X			' 1		NumIntegrate_Func_Ax_Bu_K.vi		NOT USED. Should this be used			
	X	^	(1		Null		or abandoned???			
X	X		(NumIntegrate_Rk4_Dbl_X_U.vi					
X	Χ	λ	(NumIntegrate_Rk4_Dbl_X.vi					
X		<u> </u>	(NumIntegrate_Rk4_Mat_X_U.vi					
X			(0)		NumIntegrate_Rk4_Mat_X.vi					
$\frac{X}{X}$		IN N	o SI o SI		NumIntegrate_Rkdp_Func_A.vi NumIntegrate_Rkdp_Func_B1.vi					
X		IV	o SI		NumIntegrate_Rkdp_Func_B182.vi					
X			o SI		NumIntegrate_Rkdp_Func_B2.vi					
$\frac{\lambda}{X}$			0 1		Numintegrate_Rkdp_Impl.vi					
X))	(NumIntegrate_RKDP_Mat_X_U.vi		New replacement for RKF45			
X		N	o SI		NumIntegrate Rkf45 Func A.vi		·			
X	X	N	o SI		NumIntegrate_Rkf45_Func_B1.vi					
X		N	o SI		NumIntegrate_Rkf45_Func_B1B2.vi					
X	X	N	o SI		NumIntegrate_Rkf45_Func_B2.vi					
					NumIntegrate_RKf45_Func_Bs.vi		Removed. Replaced with newer			
					NumIntegrate_RKf45_Func_Ch.vi		functions. Removed. Replaced with newer			
					Nummicgrate_NN+5_1 uno_on.vi		functions.			
					NumIntegrate_RKf45_Func_Ct.vi		Removed. Replaced with newer			
							functions.			
X			0 1		NumIntegrate_Rkf45_Impl.vi		N. a. a. e.			
X	X		(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	XX	SI		NumIntegrate_Trap_Dbl.vi					
X	X	XX	1		NumIntegrate_Trap_Mat.vi					
Implementec	Documented	Not WPILIB	Execution Optimized	Test Routine	Sample Program	Function Prototype	Notes	Code Review	Test Program	Error Checking
RUNGE KUTTA TIME VARYING X	X	N	0		RungeKuttaTimeVarying_RK4_Mat_T_Y.vi					
NUMERICAL JACOBIAN X	X X Documented	Not WPILIB	(Test Routine	WimJacobian_U.vi NumJacobian_X.vi	Function Prototype	Notes	Code Review	Test Program	Error Checking
NUMERICAL JACOBIAN X X RICCATI X	X Documented	Not WPILIB Wear them	Execution Optimized	100	VI Name NumJacobian_U.vi NumJacobian_X.vi	Function Prototype Function Prototype	Notes Routine exists, it is just a shell	(D)		
NUMERICAL JACOBIAN X mblemented	Documented X X Doc	Not WPILIB Menu Hem	Execution Optimized		VI Name NumJacobian_U.vi NumJacobian_X.vi		Notes Routine exists, it is just a shell Not really done !!!	Review Code	Test	Checking
NUMERICAL JACOBIAN X mblemented	X Documented	Not WPILIB Wear them	Execution Optimized		VI Name NumJacobian_U.vi NumJacobian_X.vi		Notes Routine exists, it is just a shell Not really done !!! Intended to allow DARE method	Review Code	Test	Checking
NUMERICAL JACOBIAN X X RICCATI X X	X X Documented	Not WPILIB	Execution Optimized	Test Routine	VI Name NumJacobian_U.vi NumJacobian_X.vi NumJacobian_X.vi NumJacobian_X.vi NumJacobian_X.vi NumJacobian_X.vi NumJacobian_		Notes Routine exists, it is just a shell Not really done !!!	Review Code	Test	Checking
NUMERICAL JACOBIAN X X papunamaldmi X X RICCATI X X	X X Documented	Not WPILIB	Execution Optimized	X Test Routine	VI Name NumJacobian_U.vi NumJacobian_X.vi		Notes Routine exists, it is just a shell Not really done !!! Intended to allow DARE method	Review Code	Test	Checking
NUMERICAL JACOBIAN X x pequebuled with the second	X X Documented	X X X X X X X X X X X X X X X X X X X	Execution Optimized	Test Routine	VI Name NumJacobian_U.vi NumJacobian_X.vi NumJacobian_X.vi NumJacobian_X.vi NumJacobian_X.vi NumJacobian_X.vi NumJacobian_X.vi NumJacobian_X.vi NumJacob		Notes Routine exists, it is just a shell Not really done !!! Intended to allow DARE method	Review Code	Test	Checking
NUMERICAL JACOBIAN X X populae and the second of the sec	X X Documented	X X X X X X X X X X X X X X X X X X X	Execution Optimized	X X Test Routine	VI Name NumJacobian_U.vi NumJacobian_X.vi VI Name Riccati_Check_Detectable.vi Riccati_Check_Stabilizable.vi Riccati_DARE_Choose.vi Riccati_DARE_Iterate.vi Riccati_DARE_StructDoubling.vi Riccati_DARE_N.vi		Notes Routine exists, it is just a shell Not really done !!! Intended to allow DARE method	Review Code	Test	Checking
NUMERICAL JACOBIAN X X Population of the second of the s	X X Documented X X X	Not WPILIB	Execution Optimized	X Test Routine	VI Name NumJacobian_U.vi NumJacobian_X.vi NumJacobian_X.vi NumJacobian_X.vi NumJacobian_X.vi NumJacobian_X.vi NumJacobian_X.vi NumJacobian_X.vi NumJacob		Notes Routine exists, it is just a shell Not really done !!! Intended to allow DARE method	Review Code	Test	Checking

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COMPUTER A X X X X X X X X X X X X X X X X X X	VI Name CompVisionUtil_CalculateDistanceToTarget.vi CompVisionUtil_EstimateCameraToTarget.vi CompVisionUtil_EstimateFieldToCamera.vi CompVisionUtil_EstimateFieldToRobot.vi CompVisionUtil_EstimateFieldToRobot_Alt.vi CompVisionUtil_ObjectToRobotPose.vi	Function Prototype	Notes	Code Review	Test Program Error Checking
Abull tem Not WPILIB Test Routine	VI Name AprilTag Equals.vi AprilTag GetAll.vi AprilTag New.vi	Function Prototype	Notes	Code Review	Test Program Error Checking
APRIL TAG FIELD LAYOUT X	VI Name AprilTagFieldLayout_GetField.vi AprilTagFieldLayout_GetOriginPosition.vi AprilTagFieldLayout_GetTagPose.vi AprilTagFieldLayout_GetTags.vi AprilTagFieldLayout_New.vi AprilTagFieldLayout_New2022.vi AprilTagFieldLayout_New2023.vi AprilTagFieldLayout_New2023.vi AprilTagFieldLayout_NewSelect.vi AprilTagFieldLayout_SetOrigin.vi AprilTagFieldLayout_SetOrigin_Position.vi	Function Prototype	Notes	Code Review	Test Program Error Checking
10 10 10 10 10 10 10 10	VI Name AprilTagPoseEstimate_GetAll.vi AprilTagPoseEstimate_GetAmbiguity.vi AprilTagPoseEstimate_New.vi	Function Prototype	Notes	Code Review	Test Program Error Checking

'========

COMMUNICATIONS

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routines for state spa	ace sir	n and	ctrl		~							
	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	Function Prototype	Notes	Code Review	Test Program	Error Checking
NETWORK UDP	X	Χ	X	X	SI		NetworkUDP_Close.vi					
	Χ	Χ	Χ	Χ	1		NetworkUDP_Receive.vi					
	Χ	X	Χ	Χ	1		NetworkUDP_Send.vi					

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

TypeDef		Z	X X X	$\overline{}$	N/A N/A	Test Routine	VI Name AprilTag.ctl AprilTagFieldLayout,ctl AprilTagFieldLayoutOriginPosition_ENUM.ctl AprilTagFields_ENUM.ctl AprilTagPoseEstimate.ctl ARM FF.CTL	Function Prototype	Notes
Z				X	N/A		BANG BANG.CTL		
1					N/A		BICon-Matrix_FUNC_TYPE.CTL		NOT USED. Should this be deleted or abandoned???
Z	? 2	Z	X	X	N/A		CALLBACK_FUNC_TYPE.CTL		
Z	7 2	Z	X	X	N/A		CHASSIS SPEEDS.CTL		
Z				X			CONTRAINED STATE.CTL		
			X	X	N/A		COORDINATE AXIS.CTL		
				X			COORDINATE SYSTEM.CTL		
			X	X	Ν/Δ		DCMOTOR SIM.CTL		
	, ,		/	^	/		DCMOTOR SIM MODEL PARAMS.CTL		OBSOLETE – Removed
Z	, .			Х			DCMOTOR SIM SIMULATION PARAMS.CTL		OBOOLETE - Nemoved
	: :		X	\hat{x}	N/A		DCMOTOR TYPES ENUM.CTL		
Z			X	X	N//A		DCMOTOR.CTL		
Z			X	X	N/A		DEBOUNCER_TYPE_ENUM.Ctl		
Z	, -		\hat{x}	\hat{x}	N/A		DEBOUNCER.CTL		
Z	, -	Z	\hat{x}	\hat{x}	N/A		DIFF_DRIVE_ACCEL_LIMIT.CTL		
Z				\hat{x}			DIFF DRIVE KINEMATICS.CTL		
Z				\hat{x}			DIFF DRIVE Kitbot WheelSize ENUM.ctl		
Z		_		\hat{x}			DIFF DRIVE ODOM2.ctl		
Z				\hat{x}			DIFF DRIVE Pose EST.ctl		
Z			\hat{x}	\hat{X}	N/A		DIFF_DRIVE_POSE_EST2.ctl		
Z			^ X	X	N/A		DIFF_DRIVE_FOSE_EST2.CUI DIFF_DRIVE_POSE_EST2_CONFIG.CTL		
				No			DIFF_DRIVE_POSE_EST2_CONFIG.CTL DIFF_DRIVE_POSE_EST2_INTERP_RECORD.CTL		
				X			DIFF_DRIVE_POSE_ESTZ_INTERP_RECORD.CTL DIFF_DRIVE_POSE_ESTZ_INTERP_RECORD.CTL		
Z	, 4		X	X	N/A		DIFF_DRIVE_ToughBoxMini_GearChoice_ENUM.cti		
Z				X			DIFF_DRIVE_TOUGHBOXWIIII_MODOLCHOICE_ENGW.cti		
				X			DIFF_DRIVE_SIM_MODEL_PARAMS DIFF_DRIVE_SIM_SIMULATION_PARAMS.CTL		
<u>Z</u>		7	Z X	X	N/A		DIFF_DRIVE_SIM_SIMULATION_PARAMS.CTL DIFF_DRIVE_TRAIN_SIM_STATE_ENUM.CTL		
Z			X	X	N/A		DIFF_DRIVE_TRAIN_SIM.ctl DISPLAY WAYPOINT.ctl		NA/ LITH NA/AN/DOINT N/I
Z					NA				Was UTIL_WAYPOINT.VI
				X	NA		DISPLAY_WEIGHTED_WAYPOINT.ctl		New V1.5. was UTIL_WEIGHTED_WAYPOINIT.VI
				Χ			ELEV_FF.CTL		
Z		_		Χ			ELEVATOR_SIM.CTL		
Z			Ζ	Χ			ELEVATOR_SIM_SIMULATION_PARAMS.CTL		
Z				Χ	N/A		EXTENDED_KALMAN_CORRECT_FUNC_GROUP.CTL		
Z	7		Z	Χ	N/A		EXTENDED_KALMAN_FILTER.CTL		
Z	. 2		X	X	N/A		FLYWHEEL_SIM.ctl		
Z	? 2	Z	Z	X	N/A		FLYWHEEL_SIM_SIMULATION_PARAMS.CTL		
Z	7 2	Z	X	Χ	N/A		FUNCTION_GENERATOR_MATRIX.ctl		

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Z	Ζ	X		N/A	FUNCTION_GENERATOR.ctl	
Z	Z	X	X	N/A	HOLONOMIC DRV CTRL.CTL	New 1/26/21
Z	Ζ	Χ		N/A	KALMAN_FILTER_LATENCY_COMP_FUNC_GROUP.CTL	
Z	Z	X	X	N/A	KALMAN FILTER LATENCY COMP.CTL	
	Z	X			KALMAN FILTER_EATENOT_GOWN .GTE	
Z			X		_	
Z	Ζ	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	Ζ	Χ	N/A	LINEAR SYSTEM ID DCMOTOR MODEL.CTL	
Z		Z	X		LINEAR SYSTEM ID ELEVATOR MODEL.CTL	
Z		Z		N/A	LINEAR SYSTEM ID FLYWHEEL MODEL.CTL	
Z		Z		N/A	LINEAR_SYSTEM_ID_SINGLE_JOINT_ARM_MODEL.CTL	
Z	Ζ	X		N/A	LINEAR_SYSTEM_LOOP.ctl	
	Ζ	Z	X	N/A	LINEAR_SYSTEM_LOOP_CTRL_PARAMS.CTL	
Ζ	Z	Z	X	N/A	LINEAR SYSTEM LOOP DCMOTOR CTRL PARAMS.CL	
Z	Ζ	Ζ	X	N/A	LINEAR SYSTEM LOOP DIFF DRV CTRL PARAMS.CTL	
Z	Z	Z		N/A	LINEAR SYSTEM LOOP ELEVATOR CTRL PARAMS.CTL	
Z	Z	Z	X		LINEAR_SYSTEM_LOOP_FLYWHEEL_CTRL_PARAMS.CTL	
Z	Z	Ζ		N/A	LINEAR_SYSTEM_LOOP_SNGJNTARM_CTRL_PARAMS.CTL	
Z	Ζ	X		N/A	LINEAR_SYSTEM_SIM.ctl	
Z	Ζ	X	X	N/A	LINEAR_SYSTEM.ctl	
Z	Z	Z	X	N/A	LTV DIFF DRIVE CTRL CONTROL PARAMS.CTL	
Z	Ζ	Ζ	X	N/A	LTV DIFF DRIVE CTRL MODEL PARAMS.CTL	
Z	Z	X	X		LTV DIFF DRIVE CTRL STATE ENUM.ctl	
Z	Z	Z		N/A	LTV_DIFF_DRIVE_CTRL_TOLERANCE.CTL	
Z	Ζ	X	X	N/A	LTV_DIFF_DRIVE_CTRL.ctl	
Z	Ζ	Ζ	X	N/A	LTV_UNICYCLE_CONTROLLER_MODEL_PARAMS.CTL	
Z	Ζ	X	X	N/A	LTV UNICYCLE CONTROLLER STATE ENUM.ctl	
Z	Ζ	Z	X	N/A	LTV UNICYCLE CONTROLLER TOLERANCE.CTL	
Z	Z	X		N/A	LTV UNICYCLE CONTROLLER.CTL	
Z	Z	X		N/A	MECA DRIVE KINEMATICS.CTL	
Z	Ζ	X	X	N/A	MECA_DRIVE_ODOMETRY.CTL	
Z	Ζ	X	X	N/A	MECA_DRIVE_POSE_EST.CTL	
Z	Z	X	X	N/A	MECA DRIVE POSE EST2.ctl	
Z	Ζ	Χ		N/A	MECA DRIVE POSE EST2 CONFIG.CTL	
Z		Х	X	N/A	MECA DRIVE POSE EST2 INTERP RECORD.CTL	
Z	Z	X	X	N/A	MECA WHEEL POSITIONS.CTL	
				_		
Z	Ζ	X		N/A	MECA_WHEEL_SPEEDS.CTL	
Z	Ζ	X	X	N/A	MEDIAN_FILTER.CTL	
Z	Ζ	X	X	N/A	MERWE_SCALED_SIGMA_PTS.ctl	
Z	Ζ	X	X	N/A	OBSERVER SNAP LIST ITEM.CTL	
Z	Ζ	Χ	Χ	N/A	OBSERVER SNAPSHOT.CTL	
Z	Ζ	X		N/A	PARAM STACK ITEM.CTL	
Z	Z	X		N/A	PARAM STACK.CTL	
				N/A	PID ADV LIMITS.CTL	
Z	<u> </u>	X				
			X		PID_ADV_TUNING.CTL	
Z	Ζ	Χ			PID_CONTROLLER.CTL	
Z	Z	X	X	N/A	PID ERROR TOLERANCE.CTL	
Z	Ζ	Χ	X	N/A	PID INPUT LIMITS.CTL	
Z	Ζ	Χ		N/A	PID TUNING.CTL	
Z	Z	X	X		POSE2D.CTL	
	Z	X		N/A	POSE2D.CTL POSE3D.CTL	
Z						
Z	Z	X		N/A	POSEwCURVATURE.CTL	
Z	Ζ	X		N/A	PROFILED_PID_CONTROLLER.CTL	
	Z	X	X	N/A	QUATERNION.CTL	
Z	Ζ	X	Χ	N/A	RAMSETE EXE TUNING.CTL	
Z	Z	X	X	N/A	RAMSETE.CTL	
Z	Z	X		N/A	ROTATION2D.CTL	
	Z				ROTATION2D.GTL	
Z		X	X	N/A		
Z	Ζ	Z		N/A	SIMPLE_MOTOR_FF_KA_TUNE_PARAMS.CTL	
Z	Ζ	Χ		N/A	SIMPLE_MOTOR_FF.CTL	
Z	Ζ	Χ	Χ	N/A	SINGLE JOINT ARM SIM.CTL	
Z	Z	X	X	N/A	SINGLE JOINT ARM SIM SIMULATION PARAMS.CTL	
Z	Z	X		N/A	SLEW RATE LIMITER.CTL	
Z	Z	X		N/A	SPLINE_CTRL_VECTOR.CTL	
Z	Z	X		N/A	SPLINE.CTL SPLINE.CTL	
Z	Ζ		X		SWERVE_DRIVE_KINEMATICS.CTL	
Z	Ζ	Χ	X	N/A	SWERVE_DRIVE_MODULE_POSITION.CTL	
Z	Z	X		N/A	SWERVE DRIVE MODULE STATE.CTL	
Z	Z		X		SWERVE DRIVE ODOMETRY.CTL	
Z	Z		X		SWERVE_DRIVE_OBOMETRY.OTE SWERVE DRIVE Pose EST.CTL	
		_ ^	_ ^	IV/A	OWELVE DIVEL 1036 EST. OIL	

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Z		X	X	N/A	SWERVE_DRIVE_POSE_EST2.ctl	
Z	Ζ	X	X	N/A	SWERVE_DRIVE_POSE_EST2_CONFIG.CTL	
Z		X	No	N/A	SWERVE_DRIVE_POSE_EST2_INTERP_RECORD.CTL	
Z	Ζ	Χ	Χ	N/A	TIME_INTERPOLATABLE_BOOLEAN.CTL	
Z	Ζ	Χ	Χ	N/A	TIME_INTERPOLATABLE_DOUBLE.CTL	
Z	Ζ	Χ	Χ	N/A	TIME_INTERPOLATABLE_POSE2D.CTL	
Z	Ζ	Χ	Χ	N/A	TIME_INTERPOLATABLE_ROTATION2D.CTL	
Z	Ζ	Ζ	Χ	N/A	TIME_INTERPOLATABLE_VARIANT.CTL	
Z	Ζ	Χ	Χ	N/A	TIMER.CTL	
Z	Ζ	Χ	Χ	N/A	TRAJ_CONFIG.CTL	
Z	Ζ	Χ	Χ	N/A	TRAJ CONSTRAINT CENTRIPETAL ACCEL.CTL	
Z	Ζ	Χ	Χ	N/A	TRAJ CONSTRAINT DIIF DRIVE KINEMATICS.CTL	
Z	Ζ	Χ	Χ	N/A	TRAJ_CONSTRAINT_DIIF_DRIVE_VOLTAGE.CTL	
Z	Ζ	Χ	Χ	N/A	TRAJ_CONSTRAINT_ELLIP_REGION.CTL	
١		Χ		N/A	TRAJ CONSTRAINT JERK.CTL	Routine exists, it is just a shell
Z	Ζ	Χ	Χ	N/A	TRAJ CONSTRAINT MAX VELOCITY.CTL	
Z	Ζ	Χ	Χ	N/A	TRAJ CONSTRAINT MECA DRIVE KINEMATICS.CTL	
Z	Ζ	Χ	Χ	N/A	TRAJ CONSTRAINT MINMAX.CTL	
Z	Ζ	Χ	Χ	N/A	TRAJ CONSTRAINT RECT REGION.CTL	
Z	Ζ	Χ	Χ	N/A	TRAJ_CONSTRAINT_SWERVE_DRIVE_KINEMATICS.CTL	
Z	Ζ	Χ	Χ	N/A	TRAJ_STATE.CTL	
Z	Ζ	Χ	Χ	N/A	TRAJECTORY SPLINE TYPE ENUM.CTL	
Z	Ζ	Χ	Χ	N/A	TRAJECTORY.CTL	
Z	Ζ	Χ	Χ	N/A	TRANSFORM2D.CTL	
Z	Ζ	Χ	Χ	N/A	TRANSFORM3D.CTL	
Z	Ζ	Χ	Χ	N/A	TRANSLATION2D.CTL	
Z	Ζ	Χ	Χ	N/A	TRANSLATION3D.CTL	
Z	Ζ	Χ	Χ	N/A	TRAPEZOID_PROFILE_CONSTRAINT.CTL	
Z	Ζ	Χ	Χ	N/A	TRAPEZOID PROFILE STATE.CTL	
Z	Ζ	Χ	Χ	N/A	TRAPEZOID PROFILE.CTL	
Z	Ζ	Χ	Χ	N/A	TWIST2D.CTL	
Z	Ζ	Χ	Χ	N/A	TWIST3D.CTL	
Z	Ζ	Χ	Χ	N/A	UNSCENTED KALMAN CORRECT FUNC GROUP.CTL	
Z	Ζ	Χ	Χ	N/A	UNSCENTED KALMAN FILTER.ctl	
Z	Ζ	X	X	N/A	UNSCENTED KALMAN NEW FUNC GROUP.CTL	
Z	Z	X	X	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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