FRC LabVIEW Trajectory Library – VI Implementation List

Revision 2.X 3\11/12/2021 – State Space Items – (This list is still missing one VI….) Added additional columns for test and sample.

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...

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program
VI / CTL Totals	720	369	217	635	229	0	0
VI Total	645						
CTL Total	75						
VI Shell Total	14						
CTRL Shell Total	3						

Doc completed Pct
51.25%
Optimization Pct
31.81%

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

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BASE
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	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
LINEAR FILTER	X	X		X	SI			LinearFilter_Calculate.vi		
	X	X	X	X	X			LinearFilter_CutoffFrequency.vi		
	X	X	X	X	I			LinearFilter_Execute.vi		Labview style helper
	X	X		X	X			LinearFilter_HighPass.vi		
	X	X	X	X	X			LinearFilter_HighPassBW1.vi		
	X	X	X	X	X			LinearFilter_HighPassBW2.vi		
	X	X	X	X	X			LinearFilter_LowPassBW1.vi		
	X	X	X	X	X			LinearFilter_LowPassBW2.vi		
	X	X		X	X			LinearFilter_MovingAverage.vi		
	X	X		X	I			LinearFilter_New.vi		
	X	X		X	SI			LinearFilter_Reset.vi		
	X	X	X	X	SI			LinearFilter_ResetToValue.vi		
	X	X		X	X			LinearFilter_SinglePoleIIR.vi		
	X	X	X	X	X			LinearFilter_TimeConst.vi		

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
MEDIAN FILTER	X	X		X	X			MedianFilter_Calculate.vi		
	X	X	X	X				MedianFilter_Execute.vi		Labview style helper
	X	X		X	SI			MedianFilter_New.vi		
	X	X		X	SI			MedianFilter_Reset.vi		
	X	X	X	X	SI			MedianFilter_ResetToValue.vi		

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
SLEW RATE FILTER	X	X		X				SlewRateLimiter_Calculate.vi		
	X	X	X	X				SlewRateLimiter_Close.vi		
	X	X	X	X				SlewRateLimiter_Execute.vi		Labview style helper
	X	X	X	X	SI			SlewRateLimiter_GetRate.vi		
	X	X		X				SlewRateLimiter_New.vi		
	X	X		X				SlewRateLimiter_NewInitialZero.vi		
	X	X		X				SlewRateLimiter_Reset.vi		
	X	X		X	SI			SlewRateLimiter_SetRate.vi		

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
TIMER	X	X	X	X				Timer_Close.vi		releases semaphore
	X	X		X				Timer_Get.vi		
	X	X	X	X				Timer_GetAndReset.vi		
	X	X	X	No				Timer_GetInternal.vi		Internal (private) only
	X	X		X				Timer_HasPeriodPassed.vi		
	X	X	X	X				Timer_HasPeriodPassedOnce.vi		
	X	X		X				Timer_New.vi		
	X	X		X				Timer_Reset.vi		
	X	X	X	No				Timer_ResetInternal		Internal (private) only
	X	X		X				Timer_Start.vi		
	X	X		X				Timer_Stop.vi		
	X	X	X	No				Timer_StopInternal.vi		Internal (private) only

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CONTROLLER
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	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
ARM FF	X	X		X				ArmFF_Calculate.vi		
	X	X		X				ArmFF_CalculateVelocityOnly.vi		
			X					ArmFF_Execute.vi		LabVIEW style single call
			X					ArmFF_ExecuteVelocityOnly.vi		LabVIEW style single call
	X	X		X				ArmFF_MaxAchieveAccel.vi		
	X	X		X				ArmFF_MaxAchieveVelocity.vi		
	X	X		X				ArmFF_MinAchieveAccel.vi		
	X	X		X				ArmFF_MinAchieveVelocity.vi		
	X	X		X				ArmFF_New.vi		
	X	X		X				ArmFF_New_ZeroGravity.vi		

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
CONTROLLER UTIL	X			X				ControllerUtil_GetModulusError.vi		This was short lived in WPILIB, but still useful here.

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
ELEV FF	X	X		X				ElevFF_Calculate.vi		
	X	X		X				ElevFF_CalculateVelocityOnly.vi		
			X					ElevFF_Execute.vi		LabVIEW style single call
			X					ElevFF_ExecuteVelocityOnly.vi		LabVIEW style single call
	X	X		X				ElevFF_MaxAchieveAccel.vi		
	X	X		X				ElevFF_MaxAchieveVelocity.vi		
	X	X		X				ElevFF_MinAchieveAccel.vi		
	X	X		X				ElevFF_MinAchieveVelocity.vi		
	X	X		X				ElevFF_New.vi		
	X	X		X				ElevFF_New_ZeroAccel.vi		

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
HOL_DRV_CTRL	X			X				HolDrvCtrl_AtReference.vi		Added 1/26/21
	X			X				HolDrvCtrl_Calculate.vi		Added 1/26/21
	X			X				HolDrvCtrl_Calculate_Trajectory.vi		Added 1/26/21
			X					HolDrvCtrl_Execute.vi		Future
			X					HolDrvCtrl_Execute_Trajectory.vi		Future
	X			X				HolDrvCtrl_New.vi		Added 1/26/21
	X			X				HolDrvCtrl_SetEnabled.vi		Added 1/26/21
	X			X				HolDrvCtrl_SetTolerance.vi		Added 1/26/21

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
PID CONTROLLER	X	X	X	X				PIDController_AdvCalculate_FF_Sp_Pv.vi		Advanced PID
	X	X	X	X				PIDController_AdvCalculate_FF_Sp_Pv_Per.vi		Advanced PID
	X	X	X	X				PIDController_AdvExecute.vi		Labview style helper. Advanced PID
	X	X		X				PIDController_AtSetpoint.vi		
	X	X		X				PIDController_Calculate_PV.vi		
	X	X		X				PIDController_Calculate_SP_PV.vi		
	X	X		X				PIDController_DisableContinousInput.vi		
	X	X		X				PIDController_EnableContinousInput.vi		
	X	X	X	X				PIDController_Execute.vi		Labview style helper
								PIDController_GetContinuousError.vi		OBSOLETE – Removed
	X	X		X				PIDController_GetPeriod.vi		

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
	X	X		X				PIDController_GetPID.vi		
	X	X		X				PIDController_GetPositionError.vi		
	X	X		X				PIDController_GetSetpoint.vi		
	X	X		X				PIDController_GetVelocityError.vi		
	X			X				PIDController_IsContinuousEnabled.vi		
	X	X		X				PIDController_New.vi		
	X	X		X				PIDController_NewPeriod.vi		
	X		X	X	SI			PIDController_Pack_AdvLimits.vi		
	X		X	X	SI			PIDController_Pack_AdvTuning.vi		
	X		X	X	SI			PIDController_Pack_ErrorTolerance.vi		
	X		X	X	SI			PIDController_Pack_InputLimits.vi		
	X		X	X	SI			PIDController_Pack_Tuning.vi		
	X	X		X				PIDController_Reset.vi		
	X	X		X				PIDController_SetD.vi		
	X	X	X	X				PIDController_SetDerivativeFilter.vi		Advanced PID
	X	X	X	No				PIDController_SetFeedForward.vi		Advanced PID, Obsolete – DELETE
	X	X	X	No				PIDController_SetFFGain.vi		Advanced PID, Obsolete – DELETE
	X	X		X				PIDController_SetI.vi		
								PIDController_SetInputRange.vi		OBSOLETE – Removed
	X	X		X				PIDController_SetIntegratorRange.vi		
	X	X	X	X				PIDController_SetOutputLimits.vi		Advanced PID
	X	X		X				PIDController_SetP.vi		
	X	X	X	X				PIDController_SetPeriod.vi		
	X	X		X				PIDController_SetPID.vi		
	X	X	X	X				PIDController_SetPIDF.vi		Advanced PID
	X	X		X				PIDController_SetSetpoint.vi		
	X	X		X				PIDController_SetTolerance.vi		
	X	X		X				PIDController_SetTolerancePandV.vi		

PROFILED PID CONTROLLER	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
	X	X		X				ProfiledPIDController_AtGoal.vi		
	X	X		X				ProfiledPIDController_AtSetpoint.vi		
	X	X		X				ProfiledPIDController_Calculate_Meas.vi		
	X	X		X				ProfiledPIDController_Calculate_Meas_Goal.vi		
	X	X		X				ProfiledPIDController_Calculate_Meas_StateGoal.vi		
	X	X		X				ProfiledPIDController_Calculate_Meas_StateGoal_TrapCnsrt.vi		
	X	X		X				ProfiledPIDController_DisableContInput.vi		
	X	X		X				ProfiledPIDController_EnableContInput.vi		
	X	X		X				ProfiledPIDController_GetGoal.vi		
	X	X		X				ProfiledPIDController_GetPeriod.vi		
	X	X	X	X				ProfiledPIDController_GetPID.vi		WPILIB has separate getters.
	X	X		X				ProfiledPIDController_GetPositionError.vi		
	X	X		X				ProfiledPIDController_GetSetpoint.vi		
	X	X		X				ProfiledPIDController_GetVelocityError.vi		
	X	X		X				ProfiledPIDController_New.vi		
	X	X		X				ProfiledPIDController_NewPeriod.vi		
	X	X		X				ProfiledPIDController_Reset.vi		
	X	X		X				ProfiledPIDController_Reset_PosOnly.vi		
	X	X		X				ProfiledPIDController_Reset_PosVel.vi		
	X	X		X				ProfiledPIDController_SetConstraints.vi		
	X	X		X				ProfiledPIDController_SetGoal.vi		
	X	X		X				ProfiledPIDController_SetGoal_PosOnly.vi		
	X	X		X				ProfiledPIDController_SetIntegratorRange.vi		
	X	X		X				ProfiledPIDController_SetPID.vi		
	X	X		X				ProfiledPIDController_SetTolerance_PosOnly.vi		
	X	X		X				ProfiledPIDController_SetTolerance_PosVel.vi		

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
RAMSETE	X	X		X	SI			Ramsete_New.vi	new	
	X	X		X	SI			Ramsete_New_B_Z.vi	new(b, zeta)	
	X	X		X	X			Ramsete_Calculate.vi	calculate	
	X	X		X	X			Ramsete_Calculate_Trajectory.vi	calculate_trajectory	
	X	X		X	SI			Ramsete_AtReference.vi	AtReference	
	X	X		X	SI			Ramsete_SetEnabled.vi	SetEnabled	
	X	X		X	SI			Ramsete_SetTolerance.vi	SetTolerance	
	X	X		X	X			Ramsete_SINC.vi	sinc	internal
	X	X	X	X	X			Ramsete_Diff_DO_Eng.vi		
	X	X	X	X	X			Ramsete_Diff_DO_SI.vi		

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
SIMPLE MOTOR FEEDFORWARD	X	X		X	SI			SimpleMotorFF_New.vi	public SimpleMotorFeedforward(double ks, double kv, double ka)	
									public SimpleMotorFeedforward(double ks, double kv)	
	X	X		X	SI			SimpleMotorFF_Calculate.vi	public double calculate(double velocity, double acceleration)	
	X	X		X	SI			SimpleMotorFF_CalculateVelocityOnly.vi	public double calculate(double velocity)	
			X					SimpleMotorFF_Execute.vi		LabVIEW style single call
			X					SimpleMotorFF_ExecuteVelocityOnly.vi		LabVIEW style single call
	X	X		X	X			SimpleMotorFF_MaxAchieveVel.vi	public double maxAchievableVelocity(double maxVoltage, double acceleration)	
	X	X		X	X			SimpleMotorFF_MinAchieveVel.vi	public double minAchievableVelocity(double maxVoltage, double acceleration)	
	X	X		X	X			SimpleMotorFF_MaxAchieveAccel.vi	public double maxAchievableAcceleration(double maxVoltage, double velocity)	
	X	X		X	X			SimpleMotorFF_MinAchieveAccel.vi	public double minAchievableAcceleration(double maxVoltage, double velocity)	

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GEOMETRY
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	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
POSE									pose2d new( )	can use cluster constant
	X	X		X	SI			Pose_New_TRRO.vi	pose2d new(translation2d, rotation2d)	
	X	X		X	SI			Pose_New.vi	pose2d new(double x, double y, rotation2d)	
	X	X		X	SI			Pose_Plus.vi	pose2d plus(transform2d other)	
	X	X		X	SI			Pose_Minus.vi	transform2d minus(pose2d other)	
	X	X		X	SI			Pose_getTranslation.vi	translation2d getTranslation()	can also use cluster unpack
	X	X		X	SI			Pose_getRotation.vi	rotation2d getRotation()	can also use cluster unpack
	X		X	X	SI			Pose_getXY.vi		
	X		X	X	SI			Pose_getXYAngle.vi		
	X	X		X	SI			Pose_TransformBy.vi	pose2d transformby(transform2d other)	
	X	X		X	SI			Pose_RelativeTo.vi	pose2d relativeto(pose2d other)	
	X	X		X	X			Pose_Exp.vi	pose2d exp(twist2d twist)	
	X	X		X	X			Pose_Log.vi	twist2d log(pose2d end)	

	X	X		X	SI			Pose_Equals.VI	boolean equals(other obj)	

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
ROTATION									rotation2d new()	can use cluster constant
	X	X		X	SI			Rotation_CreateAngle.vi	rotation2d new(double value)	
	X	X		X	SI			Rotation_CreateXY.vi	rotation2d new(double x, double y)	
	X	X		X	SI			Rotation_CreateAngleDegrees.vi	rotation2d fromDegrees(double degrees)	convert to radians then create
	X	X		X	SI			Rotation_Plus.vi	rotation2d plus(rotation2d other)	
	X	X		X	SI			Rotation_Minus.vi	rotation2d minus(rotation2d other)	
	X	X		X	SI			Rotation_UnaryMinus.vi	rotation2d unaryminus( )	
	X	X		X	SI			Rotation_Times.vi	rotation2d times(double scalar)	
	X	X		X	SI			Rotation_RotateBy.vi	rotation2d rotateby(rotation2d other)	
	X		X	X	SI			Rotation_GetAngleCosSin.vi		New 1/26/21
	X	X		X	SI			Rotation_GetRadians.VI	double getRadians()	use cluster unpack
	X	X		X	SI				double getDegrees()	use cluster unpack, then convert to degree
	X	X		X	SI			Rotation_GetCos.VI	double getCos()	use cluster unpack
	X	X		X	SI			Rotation_GetSin.VI	double getSin()	use cluster unpack
	X	X		X	SI			Rotation_GetTan.VI	double getTan()	can calculate
	X	X		X	SI			Rotation_Equals.vi	boolean equals(rotation2d other)	

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
TRANSFORM	X	X		X	SI			Transform_Create_PosePose.vi	transform2d new(pose2d, pose2d)	
	X	X		X	SI			Transform_Create_TransRot.vi	transform2d new(translation2d, rotation2d)	
									transform2d new( )	can use cluster constant
	X	X		X	SI			Transform_Times.vi	transform2d times(double scalar)	
	X	X		X	SI			Transform_GetTranslation.VI	translation2d getTranslation()	use cluster unpack
	X	X		X	SI			Transform_GetRotation.VI	rotation2d getRotation()	use cluster unpack
	X		X	X	SI			Transform_GetXY.vi		
	X		X	X	SI			Transform_GetXYAngle.vi		
	X	X		X	SI			Transform_Inverse.vi	transform inverse()	new
	X	X		X	SI			Transform_Equals.VI	boolean equals(other transform2d)	

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
TRANSLATION									translation2d new()	can use cluster constant
	X	X		X	SI			Translation_Create.vi	translation2d new(double x, double y)	
	X			X	SI			Translation_Create_DistAng.vi		
	X	X		X	SI			Translation_GetDistance.vi	double getDistance(translation2d other)	
	X	X		X	SI			Translation_GetX.VI	double getX()	can use cluster unpack
	X	X		X	SI			Translation_GetY.VI	double getY()	can use cluster unpack
	X	X	X	X	SI			Translation_GetXY.VI		
	X	X		X	SI			Translation_GetNorm.VI	double getNorm()	can use cluster unpack
	X	X		X	SI			Translation_RotateBy.vi	translation2d rotateBy(rotation2d other)	
	X	X		X	SI			Translation_Plus.vi	translation2d plus(translation2d other)	
	X	X		X	SI			Translation_Minus.vi	translation2d minus(translation2d other)	

	X	X		X	SI			Translation_UnaryMinus.vi	translation2d unaryminus( )	
	X	X		X	SI			Translation_Times.vi	translation2d times(double scalar)	
									translation2d div(double scalar)	can multiply by 1/scalar
	X	X		X	SI			Translation_Equals.vi	boolean equals(translation other)	

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
TWIST	X	X		X	SI			Twist_Create.vi	twist new(x, y, theta)	
	X	X		X	SI			Twist_Equals.VI	boolean equals(obj other)	
	X	X	X	X	SI			Twist_GetAll.VI		

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KINEMATICS
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	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
CHASSIS SPEEDS									chassisspeeds new ()	can use cluster constant
	X	X		X	SI			ChassisSpeeds_New.vi	chassisspeeds new (double xvel, double yvel, double angvel)	
	X	X		X	SI			ChassisSpeeds_FromFieldRelativeSpeeds.VI	chassisspeeds fromFieldRelativeSpeeds(double x, double y, double angvel, rotation2d robotangle)	

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
DIFFERENTIAL DRIVE KINEMATICS	X	X		X	I			DiffKinematics_New.vi	diffDriveKine new(double trackWidth)	
	X	X		X	X			DiffKinematics_toChassisSpeed.vi	chassisSpeeds toChassisSpeeds(diffDrWheelSpeeds)	
	X	X		X	SI			DiffKinematics_toWheelSpeed.vi	diffDriveWheelSpeed toWheelSpeeds(chassisSpeeds)	

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
DIFFERENTIAL DRIVE ODOMETRY									diffDrOdom new(rotation gyro, pose initial)	
									diffDrOdom new(rotation gyro)	
									void resetPosition(pose2d, rotation2d)	incorporated into “update”
									pose2d getPoseMeters()	
	X	X		X	X			DiffOdometry_Update.vi	pose2d update(rotation2d gyro, double leftdist, double right dist)	Incorporates enhanced reset

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes

Revision 2.X 3\11/12/2021 – State Space Items – (This list is still missing one VI….) Added additional columns for test and sample.

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
DIFFERENTIAL DRIVE WHEEL SPEEDS									diffDrWheelSpeeds new()	
									diffDrWheelSpeeds new(double leftVel, double rightVel)	
	X	X		X	X			DiffWheel_Normalize.vi	void normalize(double maxVel)	

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
MECANUM DRIVE KINEMATICS	X	X		X	I			MecaKinematics_New.vi		
	X	X		X	X			MecaKinematics_SetInverseKinematics.vi		
	X	X		X	X			MecaKinematics_ToChassisSpeeds.vi		
	X	X		X	X			MecaKinematics_ToWheelSpeeds.vi		
	X	X		X	X			MecaKinematics_ToWheelSpeedsZeroCenter.vi		

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
MECANUM DRIVE MOTOR VOLTAGE										

nothing done

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
MECANUM DRIVE ODOMETRY	X	X		X				MecaOdometry_New.vi		
	X	X		X				MecaOdometry_NewDefaultPose.vi		
	X	X		X				MecaOdometry_GetPose.vi		
	X	X		X				MecaOdometry_Reset.VI		
	X	X		X				MecaOdometry_Update.vi		
	X	X		X				MecaOdometry_UpdateWithTime.vi		

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
MECANUM DRIVE WHEEL SPEEDS	X	X		X	SI			MecaWheel_New.Vi	public MecanumDriveWheelSpeeds(double frontLeftMetersPerSecond, double frontRightMetersPerSecond, double rearLeftMetersPerSecond, double rearRightMetersPerSecond)	
	X	X		X	X			MecaWheel_Normalize.vi	public void normalize(double attainableMaxSpeedMetersPerSecond)	

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes

SWERVE DRIVE KINEMATICS									public SwerveDriveKinematics(Translation2d... wheelsMeters)	variable parameters (replace with array and “4” calls)
	X	X	X	X				SwerveKinematics_NewX.VI		uses array as input
	X	X	X	X				SwerveKinematics_New4.VI		For 4 module drives
	X	X		X				SwerveKinematics_ToSwerveModuleStates.VI	public SwerveModuleState[] toSwerveModuleStates(ChassisSpeeds chassisSpeeds, Translation2d centerOfRotationMeters)	
	X	X		X				SwerveKinematics_ToSwerveModuleStatesZeroCenter.VI	public SwerveModuleState[] toSwerveModuleStates(ChassisSpeeds chassisSpeeds)	
									public ChassisSpeeds toChassisSpeeds(SwerveModuleState... wheelStates)	variable parameters (replace with array and “4” calls)
	X	X	X	X				SwerveKinematics_ToChassisSpeedsX.VI		uses array as input
	X	X	X	X				SwerveKinematics_ToChassisSpeeds4.VI		For 4 module drives
	X	X	X	X				SwerveKinematics_NormalizeWheelSpeeds.vi	public static void normalizeWheelSpeeds(SwerveModuleState[] moduleStates, double attainableMaxSpeedMetersPerSecond)	

	Implemented	*Documented*	*Not WPILIB*	*Menu Item*	*Execution Optimized*	*Test Routine*	*Sample Program*	VI Name	Function Prototype	Notes
SWERVE DRIVE ODOMETRY	X	X		X				SwerveOdometry_New.VI	public SwerveDriveOdometry(SwerveDriveKinematics kinematics, Rotation2d gyroAngle, Pose2d initialPose)	
	X	X		X				SwerveOdometry_NewZeroCenter.VI	public SwerveDriveOdometry(SwerveDriveKinematics kinematics, Rotation2d gyroAngle)	
	X	X		X				SwerveOdometry_ResetPosition.VI	public void resetPosition(Pose2d pose, Rotation2d gyroAngle)	
	X	X		X				SwerveOdometry_GetPosition.VI	public Pose2d getPoseMeters()	
									public Pose2d updateWithTime(double currentTimeSeconds, Rotation2d gyroAngle, SwerveModuleState... moduleStates)	variable parameters (replace with array and “4” calls)
	X	X	X	X				SwerveOdometry_UpdateWithTimeX.VI		uses array as input
	X	X	X	X				SwerveOdometry_UpdateWithTime4.VI		For 4 module drives
									public Pose2d update(Rotation2d gyroAngle, SwerveModuleState... moduleStates)	variable parameters (replace with array and “4” calls)
	X	X	X	X				SwerveOdometry_UpdateX.VI		uses array as input
	X	X	X	X				SwerveOdometry_Update4.VI		For 4 module drives

	Implemented	*Documented*	*Not WPILIB*	*Menu Item*	*Execution Optimized*	*Test Routine*	*Sample Program*	VI Name	Function Prototype	Notes
SWERVE DRIVE MODULE STATE	X	X		X	SI			SwerveModuleState_New.vi	public SwerveModuleState(double speedMetersPerSecond, Rotation2d angle)	
	X	X		X	SI			SwerveModuleState_CompareTo.vi	public int compareTo(SwerveModuleState o)	
	X			X	SI			SwerveModuleState_Optimize.vi	public SwerveModuleState optimize(SwerveModuleState desired, Rotation2d angle)	

'============
SPLINE
'============

	Implemented	*Documented*	*Not WPILIB*	*Menu Item*	*Execution Optimized*	*Test Routine*	*Sample Program*	VI Name	Function Prototype	Notes
CUBIC HERMITE SPLINE	X	X		X				CubicHermiteSpline_New.vi	public CubicHermiteSpline(double[] xInitialControlVector, double[] xFinalControlVector, double[] yInitialControlVector, double[] yFinalControlVector)	
									protected SimpleMatrix getCoefficients()	not needed, use cluster unpack
	X	X		X				CubicHermiteSpline_makeHermiteBasis.vi	private SimpleMatrix makeHermiteBasis()	

	X	X		X				CubicHermiteSpline_getControlVectorFromArrays.vi	private SimpleMatrix getControlVectorFromArrays(double[] initialVector, double[] finalVector)	

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
POSE WITH CURVATURE	X	X		X	SI			PoseWithCurve_New.vi	public PoseWithCurvature(Pose2d poseMeters, double curvatureRadPerMeter)	
									public PoseWithCurvature()	can use cluster constant
									public Pose2d poseMeters	not needed, use cluster unpack
									public double curvatureRadPerMeter..	not needed, use cluster unpack

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
QUINTIC HERMITE SPLINE	X	X		X				QuinticHermiteSpline_New.vi	public QuinticHermiteSpline(double[] xInitialControlVector, double[] xFinalControlVector, double[] yInitialControlVector, double[] yFinalControlVector)	
									protected SimpleMatrix getCoefficients()	not needed, use cluster unpack
	X	X		X				QuinticHermiteSpline_makeHermiteBasis.vi	private SimpleMatrix makeHermiteBasis()	
	X	X		X				QuinticHermiteSpline_getControlVectorFromArrays.vi	private SimpleMatrix getControlVectorFromArrays(double[] initialVector, double[] finalVector)	

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
SPLINE (Abstract class)									Spline(int degree)	
	X	X		X				Spline_getPoint.vi	public PoseWithCurvature getPoint(double t)	
									public static class ControlVector	
									public ControlVector(double[] x, double[] y)	implemented as data structure

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
SPLINE HELPER	X	X		X				SplineHelp_GetCubicCtrlVectorsFromWayPts.vi	public static Spline.ControlVector[] getCubicControlVectorsFromWaypoints(Pose2d start, Translation2d[] interiorWaypoints, Pose2d end)	
	X		X	X				SplineHelp_GetCubicCtrlVectorsFromWeightedWayPts.vi		
	X	X		X				SplineHelp_GetQuinticCtrlVectorsFromWayPts.vi	public static List<Spline.ControlVector> getQuinticControlVectorsFromWaypoints(List<Pose2d> waypoints)	
	X		X	X				SplineHelp_GetQuinticCtrlVectorsFromWeightedWayPts.vi		
	X	X		X				SplineHelp_getCubicSplinesFromControlVectors.vi	public static CubicHermiteSpline[] getCubicSplinesFromControlVectors(Spline.ControlVector start, Translation2d[] waypoints, Spline.ControlVector end)	
	X	X	X	No				SplineHelp_GetCubicSpline_Calc1.vi		internal
	X	X	X	No				SplineHelp_GetCubicSpline_Calc2.vi		internal
	X	X	X	No				SplineHelp_GetCubicSpline_Calc3.vi		internal

	X	X		X				SplineHelp_getQuinticSplinesFromControlVectors.vi	public static QuinticHermiteSpline[] getQuinticSplinesFromControlVectors(Spline.ControlVector[] controlVectors)	
	X	X		No				SplineHelp_ThomasAlgorithm.vi	private static void thomasAlgorithm(double[] a, double[] b, double[] c, double[] d, double[] solutionVector)	internal
	X	X		X	SI			SplineHelp_GetCubicCtrlVector.vi	private static Spline.ControlVector getCubicControlVector(double scalar, Pose2d point)	
	X	X		X	SI			SplineHelp_GetQuinticCtrlVector.vi	private static Spline.ControlVector getQuinticControlVector(double scalar, Pose2d point)	

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
SPLINE PARAMETERIZER	X	X		X				SplineParam_Spline.vi	public static List<PoseWithCurvature> parameterize(Spline spline)	
	X	X		X				SplineParam_Spline_T0_T1.vi	public static List<PoseWithCurvature> parameterize(Spline spline, double t0, double t1)	
	X	X	X	No				SplineParam_StackGet.vi		internal
	X	X	X	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	VI Name	Function Prototype	Notes
TRAJECTORY	X	X		X	SI			Trajectory_New.vi	public Trajectory(final List<State> states)	
	X			X	SI			Trajectory_New_Empty.vi		
									public Pose2d getInitialPose()	can use cluster unpack, array index
									public double getTotalTimeSeconds()	not needed, use unpack
									public List<State> getStates()	not needed, use unpack
	X	X		X				Trajectory_Sample.vi	public State sample(double timeSeconds)	
	X	X	X	X				Trajectory_SampleReverse.vi		Sample in reverse order. Negate sample.
	X	X		X				Trajectory_TransformBy.vi	public Trajectory transformBy(Transform2d transform)	
	X	X		X				Trajectory_RelativeTo.vi	public Trajectory relativeTo(Pose2d pose)	
	X			X					boolean equals(other obj)	FUTURE
	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

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
TRAJECTORY_STATE									public State()	
	X	X		X	SI			TrajectoryState_New.vi	public State(double timeSeconds, double velocityMetersPerSecond, double accelerationMetersPerSecondSq, Pose2d poseMeters, double curvatureRadPerMeter)	
	X	X		X				TrajectoryState_Interpolate.vi	State interpolate(State endValue, double i)	
	X			X					boolean equals(other obj)	FUTURE

	Implemented	*Documented*	*Not WPILIB*	*Menu Item*	*Execution Optimized*	*Test Routine*	*Sample Program*	VI Name	Function Prototype	Notes
TRAJECTORY CONFIG	*X*	*X*		*X*	*SI*			TrajectoryConfig_Create.vi	public TrajectoryConfig(double maxVelocityMetersPerSecond, double maxAccelerationMetersPerSecondSq)	
									public TrajectoryConfig addConstraint(TrajectoryConstraint constraint)	Implemented differently, can't duplicate.
									public TrajectoryConfig addConstraints(List<? extends TrajectoryConstraint> constraints)	Implemented differently, can't duplicate.
	X	*X*		*X*	*SI*			TrajectoryConfig_setKinematicsDiffDrive.vi	public TrajectoryConfig setKinematics(DifferentialDriveKinematics kinematics)	
	X	*X*		*X*	*SI*			TrajectoryConfig_setKinematicsMecanumfDrive.vi	public TrajectoryConfig setKinematics(MecanumDriveKinematics kinematics)	
	X	*X*		*X*	*SI*			TrajectoryConfig_setKinematicsSwerveDrive.vi	public TrajectoryConfig setKinematics(SwerveDriveKinematics kinematics)	
									public double getStartVelocity()	can use cluster unpack
									public TrajectoryConfig setStartVelocity(double startVelocityMetersPerSecond)	
									public double getEndVelocity()	can use cluster unpack
									public TrajectoryConfig setEndVelocity(double endVelocityMetersPerSecond)	
									public double getMaxVelocity()	can use cluster unpack
									public double getMaxAcceleration()	can use cluster unpack
									public List<TrajectoryConstraint> getConstraints()	Implemented differently, can't duplicate.
									public boolean isReversed()	can use cluster unpack
	X	*X*		*X*	*SI*			TrajectoryConfig_setReversed.vi	public TrajectoryConfig setReversed(boolean reversed)	
	X	*X*	*X*	*X*	*SI*			TrajectoryConfig_setCentripetalAccel.vi		
	X	*X*	*X*	*X*	*SI*			TrajectoryConfig_setVoltageDiffDrive.vi		
									NOTE ADD OTHER "SET" ROUTINES FOR OTHER CONTRAINTS HERE, SINCE NEW CONTRAINTS ARE SPECIFIC AND NOT GENERIC.	

	Implemented	*Documented*	*Not WPILIB*	*Menu Item*	*Execution Optimized*	*Test Routine*	*Sample Program*	VI Name	Function Prototype	Notes
TRAJECTORY GENERATE	*X*	*X*		*X*				TrajectoryGenerate_Make_Cubic_CtrlVect.vi	public static Trajectory generateTrajectory(Spline.ControlVector initial, List<Translation2d> interiorWaypoints, Spline.ControlVector end, TrajectoryConfig config)	uses cubic splines
	X	*X*		*X*				TrajectoryGenerate_Make_Cubic.vi	public static Trajectory generateTrajectory(Pose2d start, List<Translation2d> interiorWaypoints, Pose2d end, TrajectoryConfig config)	uses cubic splines
	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.vi	public static Trajectory generateTrajectory(List<Pose2d> waypoints, TrajectoryConfig config)	uses quintic splines
	X	*X*		*X*				TrajectoryGenerate_splinePointsFromSplines.vi	public static List<PoseWithCurvature> splinePointsFromSplines(Spline[] splines)	

	Implemented	*Documented*	*Not WPILIB*	*Menu Item*	*Execution Optimized*	*Test Routine*	*Sample Program*	VI Name	Function Prototype	Notes
TRAJECTORY GENERATE (Control Vector)									public ControlVectorList(int initialCapacity)	may not need, just data

								public ControlVectorList()	may not need, just data
								public ControlVectorList(Collection<? extends Spline.ControlVector> collection)	may not need, just data

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
TRAJECTORY PARAMETERIZE	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)	
	X	X		No				TrajectoryParam_enforceAccel.vi	private static void enforceAccelerationLimits(boolean reverse, List<TrajectoryConstraint> constraints, ConstrainedState state)	This routines needs to be changed when new constraints are added.
	X	X	X	No				TrajectoryParam_calcStuffFwd.vi		
	X	X	X	No				TrajectoryParam_calcStuffRev.vi		
	X	X	X	No				TrajectoryParam_enforceVelocity.vi		This routines needs to be changed when new constraints are added.

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
TRAJECTORY PARAMETERIZE CONSTRAINED STATE	X	X		X				ConstrainedState_New.vi	ConstrainedState(PoseWithCurvature pose, double distanceMeters, double maxVelocityMetersPerSecond, double minAccelerationMetersPerSecondSq, double maxAccelerationMetersPerSecondSq)	
									ConstrainedState()	
	X	X	X	X				ConstrainedState_SetMaxAccel.vi		
	X	X	X	X				ConstrainedState_SetMinAccel.vi		
	X	X	X	X				ConstrainedState_SetVelAccel.vi		
	X	X	X	X				ConstrainedState_SetVelocity.vi		

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
TRAJECTORY UTIL	X	X		X				TrajectoryUtil_fromPathWeaverJSON.vi	public static Trajectory fromPathweaverJson(Path path)	
	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)	

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
TRAPEZOID PROFILE	X	X		X				TrapProfConstraint_New.vi		
	X	X		X				TrapProfile_Calculate.vi		

X	X		No				TrapProfile_Direct.vi		Private, remove from menu
X	X	X	X				TrapProfile_Execute.vi		
X	X		X				TrapProfile_IsFinished.vi		
X	X		X				TrapProfile_New.vi		
X	X		X				TrapProfile_New_DefInitial.vi		
X	X		No				TrapProfile_ShouldFlipAcceleration.vi		Private, remove from menu
X	X		X				TrapProfile_TimeLeftUntil.vi		
X	X		X				TrapProfile_TotalTime.vi		
X	X		X				TrapProfState_Equals.vi		
X	X		X				TrapProfState_New.vi		

'============
TRAJECTORY CONSTRAINT
'============

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
CENTRIPETAL ACCELERATION CONSTRAINT	X	X		X				CentripetalAccelConstraint_getMaxVelocity.vi	public double getMaxVelocityMetersPerSecond(Pose2d poseMeters, double curvatureRadPerMeter, double velocityMetersPerSecond)	
	X	X		X				CentripetalAccelConstraint_getMinMaxAccel.vi	public MinMax getMinMaxAccelerationMetersPerSecondSq(Pose2d poseMeters, double curvatureRadPerMeter, double velocityMetersPerSecond)	
	X	X		X	SI			CentripetalAccelConstraint_New.vi	public CentripetalAccelerationConstraint(double maxCentripetalAccelerationMetersPerSecondSq)	Can use cluster pack for now

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	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 getMinMaxAccelerationMetersPerSecondSq(Pose2d poseMeters, double curvatureRadPerMeter, double velocityMetersPerSecond)	
	X	X		X	SI			DiffDriveKinematicsConstraint_New.vi	public DifferentialDriveKinematicsConstraint(final DifferentialDriveKinematics kinematics, double maxSpeedMetersPerSecond)	

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
DIFF DRIVE VOLTAGE CONSTRAINT	X	X		X				DiffDriveVoltageConstraint_getMaxVelocity.vi	public double getMaxVelocityMetersPerSecond(Pose2d poseMeters, double curvatureRadPerMeter, double velocityMetersPerSecond)	
	X	X		X				DiffDriveVoltageConstraint_getMinMaxAccel.vi	public MinMax getMinMaxAccelerationMetersPerSecondSq(Pose2d poseMeters, double curvatureRadPerMeter, double velocityMetersPerSecond)	Code updated to match 2/2020 library update.
	X	X		X	SI			DiffDriveVoltageConstraint_New.vi	public DifferentialDriveVoltageConstraint(SimpleMotorFeedforward feedforward, DifferentialDriveKinematics kinematics, double maxVoltage)	Can use cluster pack for now

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
JERK CONSTRAINT	/		X					JerkConstraint_getMaxVelocity.vi	Routine exists, it is just a shell	FUTURE
	/		X					JerkConstraint_getMinMaxAccel.vi	Routine exists, it is just a shell	FUTURE
	/		X		SI			JerkConstraint_New.vi	Routine exists, it is just a shell	FUTURE

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
MECANUM DRIVE KINEMATICS CONSTRAINT	X	X		X	SI			MecaDriveKinematicsConstraint_New.vi		
	X	X		X				MecaDriveKinematicsConstraint_getMaxVelocity.vi		
	X	X		X				MecaDriveKinematicsConstraint_getMinMaxAccel.vi		

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
SWERVE DRIVE KINEMATICS CONSTRAINT	X	X		X				SwerveDriveKinematicsConstraint_getMaxVelocity.vi	public double getMaxVelocityMetersPerSecond(Pose2d poseMeters, double curvatureRadPerMeter, double velocityMetersPerSecond)	
	X	X		X				SwerveDriveKinematicsConstraint_getMinMaxAccel.vi	public MinMax getMinMaxAccelerationMetersPerSecondSq(Pose2d poseMeters, double curvatureRadPerMeter, double velocityMetersPerSecond)	
	X	X		X	SI			SwerveDriveKinematicsConstraint_New.vi	Newpublic SwerveDriveKinematicsConstraint(final SwerveDriveKinematics kinematics, double maxSpeedMetersPerSecond)	Can use cluster pack for now

TRAJECTORY CONSTRAINT

Interface class - nothing done (not needed)

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

'============
UTILITY
'============
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	VI Name	Function Prototype	Notes
UTIL	X	X	X	X				Util_Array_PoseWCurv_to_XY.vi		
	X	X	X	X	SI			Util_CalcDist.vi		
	X	X	X	X	SI			Util_GetLibraryVersion.vi		
	X	X	X	X	SI			Util_GetLibraryUsage.vi		
	X	X	X	X				Util_GetTime.vi		Once tested completely, this should be optimized!
	X	X	X	No	N/A			Util_LibraryGlobals.vi		Global Variables – no block diag.
	X	X	X	X				Util_Trajectory_Absolute_To_Relative.vi		
	X	X	X	X				Util_Trajectory_ReadFile.vi		
	X		X	X				Util_Trajectory_to_XY.vi		
	X	X	X	X				Util_Trajectory_WriteFile.vi		
	X	X	X	No				Util_Trajectory_WriteFile_Config.vi		internal
	X	X	X	No				Util_Trajectory_WriteFile_OneState.vi		internal
	X	X	X	X				Util_Trajectory_WriteFile_PathFinder.vi		
	X	X	X	No				Util_Trajectory_WriteFile_PathFinderConfig.vi		internal
	X	X	X	X				Util_Trajectory_WriteFile_Pathweaver.vi		
	X	X	X	No				Util_Trajectory_WriteFile_States.vi		internal
	X	X	X	No				Util_Trajectory_WriteFile_WayPoints.vi		internal
	X	X	X	X				Util_TrajectoryState_Meters_To_Inches.vi		
	X	X	X	X				Util_TrajState_to_DiffDrive_WheelPos.vi		
	X	X	X	X				Util_Waypoint_Eng_To_SI.vi		
	X	X	X	X				Util_Waypoint_To_CubicInput.vi		
	X	X	X	X				Util_Waypoint_To_QuinticInput.vi		
	X	X	X	?				Util_WeightedWayPoint_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	VI Name	Function Prototype	Notes
CONV	X	X	X	X	SI			Conv_AngleDegrees_Heading.vi		
	X	X	X	X	SI			Conv_AngleRadians_Heading.vi		
	X	X	X	X	SI			Conv_Centimeters_Meters.vi		
	X	X	X	X	SI			Conv_Deg_Radians.vi		
	X	X	X	X	SI			Conv_Feet_Meters.vi		
	X	X	X	X	SI			Conv_GyroDegrees_Heading.vi		
	X	X	X	X	SI			Conv_Heading_AngleRadians.vi		
	X	X	X	X	SI			Conv_Inches_Meters.vi		
	X		X	X				Conv_Kilograms_Pounds.vi		
	X	X	X	X	SI			Conv_Meters_Feet.vi		
	X	X	X	X	SI			Conv_Meters_Inches.vi		
	X	X	X	X	SI			Conv_POSE_SI_Eng.vi		
	X		X	X				Conv_Pounds_Kilograms.vi		
	X	X	X	X	SI			Conv_Radians_Deg.vi		
	X	X	X	X	SI			Conv_Yards_Meters.vi		

Revision 2.X 3\11/12/2021 – State Space Items – (This list is still missing one VI….) Added additional columns for test and sample.

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
UNITS	X			X				Units_DegreesToRadians.vi		
	X			X				Units_FeetToMeters.vi		
	X			X				Units_InchesToMeters.vi		
	X			X				Units_MetersToFeet.vi		
	X			X				Units_MetersToInches.vi		
	X			X				Units_RadiansPerSecondToRotationsPerMinute.vi		
	X			X				Units_RadiansToDegrees.vi		
	X			X				Units_RotationsPerMinuteToRadiansPerSecond.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 Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
PATHFINDERUTIL	X	X	X	X				PathfinderUtil_Continuous_Heading_Difference.vi		
	X	X	X	X				PathfinderUtil_OptimizeTrajectoryStates.vi		
	X	X	X	X				PathfinderUtil_ToTrajectory.vi		
	X	X	X	X				PathfinderUtil_ToTrajectoryStates.vi		

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

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

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

'============
STATE SPACE ESTIMATION
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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 Checking
DIFFERENTIAL DRIVE POSE ESTIMATOR	/			X				DiffDrivePoseEst_AddVisionMeasurement.vi		Just a shell, not functional!			
	/							DiffDrivePoseEst_BiConsum_VisionCorrect.vi					
	X			X				DiffDrivePoseEst_BiFunc_F.vi					
	X			X				DiffDrivePoseEst_BiFunc_H.vi					
	X			X				DiffDrivePoseEst_FillStateVector.vi					
	X			X				DiffDrivePoseEst_GetEstimatedPosition.vi					
	X			X				DiffDrivePoseEst_New.vi					
	X			X				DiffDrivePoseEst_ResetPosition.vi					
	X			X				DiffDrivePoseEst_SetVisionMeasurementStdDevs.vi					
	X			X				DiffDrivePoseEst_Update.vi					
	X			X				DiffDrivePoseEst_UpdateWithTime.vi					

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

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
KALMAN FILTER	X			X				KalmanFilter_Correct.vi					
	X			X				KalmanFilter_New.vi					
	X			X				KalmanFilter_Predict.vi					
	X			X				KalmanFilter_Reset.vi					
	X			X				KalmanFilter_GetK					
	X			X				KalmanFilter_GetK_Single.vi					
	X			X				KalmanFilter_SetXHat					
	X			X				KalmanFilter_SetXHat_Initial					
	X			X				KalmanFilter_GetXHat					
	X			X				KalmanFilter_GetXHaT_Single					

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
KALMAN FILTER LATENCY COMPENSATOR	/							KalmanFilterLatencyComp_AddObserverState.vi		Work in progress.			
	/							KalmanFilterLatencyComp_ApplyPastGlobalMeasurement_UKF.vi		Work in progress.			
	/							KalmanFilterLatencyComp_FindClosestMeasurement.vi		Work in progress.			
	/							KalmanFilterLatencyComp_New.vi		Work in progress.			

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

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STATE SPACE CONTROL
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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 Checking
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
LINEAR PLANT INVERSION FEEDFORWARD	X			X				LinearPlntInvFF_Calculate.vi					
	X			X				LinearPlntInvFF_Calculate_NextR.vi					
	X			X				LinearPlntInvFF_GetUff.vi					
	X			X				LinearPlntInvFF_New.vi					
	X			X				LinearPlntInvFF_New_Plant.vi					
	X			X				LinearPlntInvFF_Reset_Initial.vi					
	X			X				LinearPlntInvFF_Reset_Zero.vi					
	X			X				LinearPlntInvFF_GetUff_Single.vi					
	X			X				LinearPlntInvFF_GetR.vi					
	X			X				LinearPlntInvFF_GetR_Single.vi					

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
LINEAR QUADRATIC REGULATOR	X			X				LinearQuadraticRegulator_Calculate_NextR.vi					
	X			X				LinearQuadraticRegulator_Calculate.vi					
	X			X				LinearQuadraticRegulator_GetK_Single.vi		NOT ORIGINAL…			
	X			X				LinearQuadraticRegulator_GetK.vi					
	X			X				LinearQuadraticRegulator_GetR_Single.vi					
	X			X				LinearQuadraticRegulator_GetR.vi					
	X			X				LinearQuadraticRegulator_GetU_Single.vi					
	X			X				LinearQuadraticRegulator_GetU.vi					
	/			X				LinearQuadraticRegulator_LatencyCompensate.vi		Routine exists, but it only has interger raise matrix to power.			
	X			X				LinearQuadraticRegulator_New_ELMS.vi					
								LinearQuadraticRegulator_New_Raw.vi					
	X			X				LinearQuadraticRegulator_New_SystemELMS.vi					
	X			X				LinearQuadraticRegulator_New.vi					
	X			X				LinearQuadraticRegulator_Reset.vi					

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
LINEAR SYSTEM	X			X				LinearSystem_CalculateX.vi					
	X			X				LinearSystem_CalculateY.vi					

X			X				LinearSystem_GetA.vi					
X			X				LinearSystem_GetAElement.vi					
X			X				LinearSystem_GetB.vi					
X			X				LinearSystem_GetBElement.vi					
X			X				LinearSystem_GetC.vi					
X			X				LinearSystem_GetCElement.vi					
X			X				LinearSystem_GetD.vi					
X			X				LinearSystem_GetDElement.vi					
X			X				LinearSystem_New.vi					

	Implemented	*Documented*	*Not WPILIB*	*Menu Item*	*Execution Optimized*	*Test Routine*	*Sample Program*	VI Name	Function Prototype	Notes	*Code Review*	*Test Program*	*Error Checking*
LINEAR SYSTEM LOOP	X			X				LinearSystemLoop_ClampInput.vi					
	X			X				LinearSystemLoop_Correct.vi					
								LinearSystemLoop_GetClampFunction.vi					
	X			X				LinearSystemLoop_GetController.vi					
	X			X				LinearSystemLoop_GetError_Single.vi					
	X			X				LinearSystemLoop_GetError.vi					
	X			X				LinearSystemLoop_GetFeedForward.vi					
	X			X				LinearSystemLoop_GetNextR_Single.vi					
	X			X				LinearSystemLoop_GetNextR.vi					
	X			X				LinearSystemLoop_GetObserver.vi					
	X			X				LinearSystemLoop_GetU_Row.vi					
	X			X				LinearSystemLoop_GetU.vi					
	X			X				LinearSystemLoop_GetXHat_Single.vi					
	X			X				LinearSystemLoop_GetXHat.vi					
								LinearSystemLoop_New_BBB					
								LinearSystemLoop_New_LinearSystem_ClampFunc					
	X			X				LinearSystemLoop_New_LinearSystem_ClampVal.vi					
	X			X				LinearSystemLoop_New.vi					
	X			X				LinearSystemLoop_Predict.vi					
	X			X				LinearSystemLoop_Reset.vi					
								LinearSystemLoop_SetClampFunction.vi					
								LinearSystemLoop_SetNextR_Some.vi					
	X			X				LinearSystemLoop_SetNextR.vi					
								LinearSystemLoop_SetXHat_Single.vi					
								LinearSystemLoop_SetXHat.vi					

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STATE SPACE UTILITIES
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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 Checking*
Bi-FUNCTION HELP	X		X	X				BiFuncHelp_MatrixMinus.vi					
	X		X	X				BiFuncHelp_MatrixMult.vi					
	X		X	X				BiFuncHelp_MatrixMult_CoerceSizeB.vi					
	X		X	X				BiFuncHelp_MatrixPlus.vi					

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
DISCRETIZATION	X			X				Discretization_DiscretizeA.vi					
	X			X				Discretization_DiscretizeAB.vi					
	X			X				Discretization_DiscretizeABTaylor.vi					
	X			X				Discretization_DiscretizeAQTaylor.vi					
	X			X				Discretization_DiscretizeR.vi					

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
STATE SPACE UTIL	X			X				StateSpaceUtil_MakeCostMatrix.vi					
	X			X				StateSpaceUtil_MakeCovarianceMatrix.vi					
	X			X				StateSpaceUtil_MakeWhiteNoiseVector.vi					
	/							StateSpaceUtil_IsStabalizable.vi					
	X			X				StateSpaceUtil_PoseToVector.vi					
	X			X				StateSpaceUtil_ClampInputMaxMagnitude.vi		Routine exists, it is just a shell			
	X			X				StateSpaceUtil_NomalizeInputVector.vi					
	X			X				StateSpaceUtil_PoseTo4dVector.vi					
	X			X				StateSpaceUtil_PoseTo3dVector.vi					

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SIMULATION
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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 Checking
BATTERY SIM	X			X				BatterySim_CalculateDefaultBatteryLoadedVoltage.vi					
	X			X				BatterySim_CalculateLoadedVoltage.vi					

	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 TRAIN SIM	X							DiffDriveTrainSim_ClampInput.vi					
	X							DiffDriveTrainSim_CreateKitbotSim.vi					
	X							DiffDriveTrainSim_CreateKitbotSim_EstMass.vi					
	X							DiffDriveTrainSim_CreateKitbotSim_EstMassMOI.vi					
	X							DiffDriveTrainSim_GetCurrentDrawAmps.vi					
	X							DiffDriveTrainSim_GetCurrentGearing.vi					
	X							DiffDriveTrainSim_GetDynamics.vi					
	X							DiffDriveTrainSim_GetHeading.vi					
	X							DiffDriveTrainSim_GetLeftCurrentDrawAmps.vi					
	X							DiffDriveTrainSim_GetLeftPositionMeters.vi					

	X							DiffDriveTrainSim_GetLeftVelocityMetersPerSecond.vi				
	X							DiffDriveTrainSim_GetOutput_Single.vi				
	X							DiffDriveTrainSim_GetPose.vi				
	X							DiffDriveTrainSim_GetRightCurrentDrawAmps.vi				
	X							DiffDriveTrainSim_GetRightPositionMeters.vi				
	X							DiffDriveTrainSim_GetRightVelocityMetersPerSecond.vi				
	X							DiffDriveTrainSim_GetState.vi				
	X							DiffDriveTrainSim_GetState_Single.vi				
	X							DiffDriveTrainSim_KitBotWheelSize.vi				
	X							DiffDriveTrainSim_New.vi				
	X							DiffDriveTrainSim_New_Mass_MOI.vi				
	X							DiffDriveTrainSim_SetCurrentGearing.vi				
	X							DiffDriveTrainSim_SetInputs.vi				
	X							DiffDriveTrainSim_SetPose.vi				
	X							DiffDriveTrainSim_SetState.vi				
	X							DiffDriveTrainSim_ToughBoxMiniGearRatio.vi				
	X							DiffDriveTrainSim_ToughBoxMiniMotor.vi				
	X							DiffDriveTrainSim_Update.vi				

	Implemented	*Documented*	*Not WPILIB*	*Menu Item*	*Execution Optimized*	*Test Routine*	*Sample Program*	VI Name	Function Prototype	Notes	*Code Review*	*Test Program*	*Error Checking*
ELEVATOR SIM	X			X				ElevatorSim_New.vi					
	X			X				ElevatorSim_GetCurrentDraw.vi					
	X			X				ElevatorSim_GetPositionMeters.vi					
	X			X				ElevatorSim_GetVelocityMetersPerSecond.vi					
	X			X				ElevatorSim_SetInputVoltage.vi					
	X			X				ElevatorSim_UpdateX.vi					
	X			X				ElevatorSim_WouldHitLowerLimit.vi					
	X			X				ElevatorSim_WouldHitUpperLimit.vi					
	X		X	X				ElevatorSim_Update.vi		Needed because this doesn't extend.			
	X			X				ElevatorSim_HasHitLowerLimit.vi					
	X			X				ElevatorSim_HasHitUpperLimit.vi					
	X		X					ElevatorSim_RKF45_Func.vi					
								ElevatorSim_New_NoNoise.vi					
								ElevatorSim_New_LinSys.vi					
								ElevatorSim_New_LinSys_NoNoise.vi					

	Implemented	*Documented*	*Not WPILIB*	*Menu Item*	*Execution Optimized*	*Test Routine*	*Sample Program*	VI Name	Function Prototype	Notes	*Code Review*	*Test Program*	*Error Checking*
FLYWHEEL SIM	X			X				FlyWheelSim_GetAngularVelocityRadPerSec.vi					
	X			X				FlyWheelSim_New_MOI.vi					
	X			X				FlyWheelSim_SetInput.vi					
	X			X				FlyWheelSim_Update.vi					
	X			X				FlyWheelSim_GetCurrentDrawAmps					
	X			X				FlyWheelSim_GetAngularVelocityRPM.vi					
								FlyWheelSim_New_LinSys_NoNoise		Future			
								FlyWheelSim_New_LinSys		Future			
								FlyWheelSim_New_LinSys_MOI_NoNoise		Future			

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
LINEAR SYSTEM SIM	X			X				LinearSystemSim_GetOutput.vi					
	X			X				LinearSystemSim_GetOutput_Single.vi					
	X			X				LinearSystemSim_New					
	X			X				LinearSystemSim_SetInput_Single.vi					
	X			X				LinearSystemSim_Update.vi					
	X			No				LinearSystemSim_UpdateX.vi					
	X		X	No				LinearSystemSim_UpdateY.vi					
								LinearSystemSim_New_NoNoise.vi					
	X							LinearSystemSim_SetInput.vi					
	X			X				LinearSystemSim_SetInput_Array.vi		Doesn't use clamp ?			
	X			X				LinearSystemSim_Setstate.vi					
								LinearSystemSim_GetCurrentDrawAmps.vi		DONT IMPLEMENT…			
	X							LinearSystemSim_ClampInput.vi					

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
SINGLE JOINT ARM SIM	X			X				SngJntArmSim_EsitmateMOI.vi					
	X			X				SngJntArmSim_GetAngleRads.vi					
	X			X				SngJntArmSim_GetCurrentDraw.vi					
	X			X				SngJntArmSim_GetVelocityRadsPerSec.vi					
	X			X				SngJntArmSim_HasHitLowerLimit.vi					
	X			X				SngJntArmSim_HasHitUpperLimit.vi					
	X			X				SngJntArmSim_New.vi					
	X							SngJntArmSim_Rkf45_Func.vi					
	X			X				SngJntArmSim_SetInputVoltage.vi					
	X			X				SngJntArmSim_Update.vi					
	X			X				SngJntArmSim_UpdateX.vi					
	X			X				SngJntArmSim_WouldHitLowerLimit.vi					
	X			X				SngJntArmSim_WouldHitUpperLimit.vi					

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MATRIX UTILITIES
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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 Checking
MAT BUILDER	X			X				MatBuilder_Fill.vi					
	X			X				MatBuilder_Create.vi					

	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				Matrix_AssignBlock.vi					
	X			X				Matrix_Block.vi					
	X			X				Matrix_Create.vi					
	X			X				Matrix_Diag.vi					
	X			X				Matrix_ElementSum.vi					
	X			X				Matrix_Exp.vi					
	X			X				Matrix_ExtractColumnVector.vi					
	X			X				Matrix_ExtractFrom.vi					
	X			X				Matrix_ExtractRowVector.vi					
	X			X				Matrix_Fill.vi					
	X			X				Matrix_Ident.vi					
	X			X				Matrix_IsEqual.vi					
	X			X				Matrix_LltDecompose.vi					
	X			X				Matrix_Pow.vi					
	X			X				Matrix_SetColumn.vi					
	X			X				Matrix_SetRow.vi					

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
MATRIX HELPER	X		X	X				MatrixHelper_Zero.vi					
	X		X	X				MatrixHelper_CooerceSize.vi					
	X		X	X				MatrixHelper_MultCooerceBSize.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 BUILDER	X			X				VecBuilder_1x1Fill.vi					
	X			X				VecBuilder_2x1Fill.vi					
	X			X				VecBuilder_3x1Fill.vi					
	X			X				VecBuilder_4x1Fill.vi					
	X							VecBuilder_5x1Fill.vi					
	X							VecBuilder_6x1Fill.vi					
	X							VecBuilder_7x1Fill.vi					
	X							VecBuilder_8x1Fill.vi					
								VecBuilder_9x1Fill.vi					
								VecBuilder_10x1Fill.vi					
	X		X	X				VecBuilder_ArrayBy1Fill.vi					

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MATH
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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 Checking
ANGLE STATISTICS	X			X				AngleStats_AngleAdd.vi					
	X		X	X				AngleStats_AngleAdd_BiFunc.vi					
	X			X				AngleStats_AngleMean.vi					
	X		X	X				AngleStats_AngleMean_BiFunc.vi					
	X			X				AngleStats_AngleResidual.vi					
	X		X	X				AngleStats_AngleResidual_BiFunc.vi					

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
MATH UTILITY	X			X				MathUtil_AngleModulus.vi					
	X			X				MathUtil_Clamp.vi					
	X			X				MathUtil_Clamp_Int.vi					
	X			X				MathUtil_InputModulus.vi					

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
MERWE SCALED SIGMA POINTS	X							MerweScSigPts_ComputeWeights.vi					
	X							MerweScSigPts_GetNumSigmas.vi					
	X							MerweScSigPts_GetWc.vi					
	X							MerweScSigPts_GetWc_Single.vi					
	X							MerweScSigPts_GetWm.vi					
	X							MerweScSigPts_GetWm_Single.vi					
	X							MerweScSigPts_New.vi					
	X							MerweScSigPts_New_Default.vi					
	X							MerweScSigPts_SigmaPoints.vi					

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
NUMERICAL INTEGRATION	X			No				NumIntegrate_Func_Ax_Bu_K.vi					
	X			No				NumIntegrate_Func_Bs.vi					
	X			No				NumIntegrate_Func_Ch.vi					
	X			No				NumIntegrate_Func_Ct.vi					
	/							NumIntegrate_Rk4_Dbl.vi		NOT DONE			
	/							NumIntegrate_Rk4_K_Dbl.vi		NOT DONE			
	X			X				NumIntegrate_Rk4_Mat_X.vi					
	X			X				NumIntegrate_Rk4_Mat_X_U.vi					
	X			X				NumIntegrate_Rkf45.vi					
	X			No				NumIntegrate_Rkf45Impl.vi					

	X			X				NumIntegrate_Trap_Dbl.vi				
	X			X				NumIntegrate_Trap_Mat.vi				

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
NUMERICAL JACOBIAN	X			X				NumJacobianX.vi		There are others that may need implemented.			

	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes	Code Review	Test Program	Error Checking
RICCATI	/			X				Riccati_Check_Detectable.vi		Routine exists, it is just a shell			
	X			X				Riccati_Check_Stabilizable.vi		Not really done !!!			
	X			X				Riccati_DARE.vi					
	X			X				Riccati_DARE_Iterate.vi					
	X			X				Riccati_Input_Check.vi					

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TYPE DEFINITIONS
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	Implemented	Documented	Not WPILIB	Menu Item	Execution Optimized	Test Routine	Sample Program	VI Name	Function Prototype	Notes
TypeDef	Z		X	X	N/A			ARM_FF.CTL		
	\		X	X	N/A			BICon-Matrix_FUNC_TYPE.CTL		
	Z		X	X	N/A			BiFun_Matrix_FUNC_TYPE.CTL		
	Z	X	X	X	N/A			CHASSIS_SPEEDS.CTL		
	Z	X	X	X	N/A			CONTRAINED_STATE.CTL		
	Z		X	X	N/A			DCMOTOR.CTL		
	Z	X	X	X	N/A			DIFF_DRIVE_KINEMATICS.CTL		
	Z		X		N/A			DIFF_DRIVE_Kitbot_WheelSize_ENUM.ctl		
	Z		X		N/A			DiFF_DRIVE_POSE_EST.ctl		
	Z		X		N/A			DIFF_DRIVE_ToughBoxMini_GearChoice_ENUM.ctl		
	Z		X		N/A			DIFF_DRIVE_ToughBoxMini_MotorChoice_ENUM.ctl		
	Z		X		N/A			DIFF_DRIVE_TRAIN_SIM.ctl		
	Z		X	X	N/A			ELEVATOR_SIM.CTL		
	Z		X	X	N/A			ELEV_FF.CTL		
	Z		X	X	N/A			EXTENDED_KALMAN_CORRECT_FUNC_GROUP.CTL		
	Z		X	X	N/A			ExTENDED_KALMAN_FILTER.CTL		
	Z		X	X	N/A			FLYWHEEL_SIM.ctl		
	Z		X	X	N/A			HOLONOMIC_DRV_CTRL.CTL		New 1/26/21
	Z		X	X	N/A			KALMAN_FILTER.ctl		

\		X	X	N/A			KALMAN_FILTER_LATENCY_COMP.CTL		
Z	X	X	X	N/A			LINEAR_FILTER.CTL		
Z		X	X	N/A			LINEAR_PLANT_INV_FF.ctl		
Z		X	X	N/A			LINEAR_QUADRATIC_REGULATOR.ctl		
Z		X	X	N/A			LINEAR_SYSTEM_LOOP.ctl		
Z		X	X	N/A			LINEAR_SYSTEM_SIM.ctl		
Z		X	X	N/A			LINEAR_SYSTEM.ctl		
Z	X	X	X	N/A			MECA_DRIVE_KINEMATICS.CTL		
Z	X	X	X	N/A			MECA_DRIVE_ODOMETRY.CTL		
Z	X	X	X	N/A			MECA_WHEEL_SPEEDS.CTL		
Z		X	X	N/A			MEDIAN_FILTER.CTL		
Z		X		N/A			MERWE_SCALED_SIGMA_PTS.ctl		
Z		X		N/A			OBSERVER_SNAPSHOT.CTL		
Z		X		N/A			OBSERVER_SNAP_LIST_ITEM.CTL		
Z	X	X	X	N/A			PARAM_STACK_ITEM.CTL		
Z	X	X	X	N/A			PARAM_STACK.CTL		
Z		X	X	N/A			PID_ADV_LIMITS.CTL		
Z		X	X	N/A			PID_ADV_TUNING.CTL		
Z		X	X	N/A			PID_CONTROLLER.CTL		
Z		X	X	N/A			PID_ERROR_TOLERANCE.CTL		
Z		X	X	N/A			PID_INPUT_LIMITS.CTL		
Z		X	X	N/A			PID_TUNING.CTL		
Z	X	X	X	N/A			POSE2D.CTL		
Z	X	X	X	N/A			POSEwCURVATURE.CTL		
Z		X	X	N/A			PROFILED_PID_CONTROLLER.CTL		
Z	X	X	X	N/A			RAMSETE.CTL		
Z	X	X	X	N/A			ROTATION2D.CTL		
Z		X	X	N/A			SINGLE_JOINT_ARM_SIM.CTL		
Z	X	X	X	N/A			SIMPLE_MOTOR_FF.CTL		
Z		X	X	N/A			SLEW_RATE_LIMITER.CTL		
Z	X	X	X	N/A			SPLINE_CTRL_VECTOR.CTL		
Z	X	X	X	N/A			SPLINE.CTL		
Z	X	X	X	N/A			SWERVE_DRIVE_KINEMATICS.CTL		
Z	X	X	X	N/A			SWERVE_DRIVE_MODULE_STATE.CTL		
Z	X	X	X	N/A			SWERVE_DRIVE_ODOMETRY.CTL		
Z		X	X	N/A			TIMER.CTL		
Z	X	X	X	N/A			TRAJ_CONFIG.CTL		
Z	X	X	X	N/A			TRAJ_CONSTRAINT_CENTRIPETAL_ACCEL.CTL		
Z	X	X	X	N/A			TRAJ_CONSTRAINT_DIFF_DRIVE_KINEMATICS.CTL		
Z	X	X	X	N/A			TRAJ_CONSTRAINT_DIFF_DRIVE_VOLTAGE.CTL		
\		X		N/A			TRAJ_CONSTRAINT_JERK.CTL		Routine exists, it is just a shell
Z	X	X	X	N/A			TRAJ_CONSTRAINT_MECA_DRIVE_KINEMATICS.CTL		
Z	X	X	X	N/A			TRAJ_CONSTRAINT_MINMAX.CTL		
Z	X	X	X	N/A			TRAJ_CONSTRAINT_SWERVE_DRIVE_KINEMATICS.CTL		
Z	X	X	X	N/A			TRAJ_STATE.CTL		
Z	X	X	X	N/A			TRAJECTORY.CTL		
Z	X	X	X	N/A			TRANSFORM2D.CTL		
Z	X	X	X	N/A			TRANSLATION2D.CTL		
Z		X	X	N/A			TRAPEZOID_PROFILE_CONSTRAINT.CTL		
Z		X	X	N/A			TRAPEZOID_PROFILE_STATE.CTL		
Z		X	X	N/A			TRAPEZOID_PROFILE.CTL		
Z	X	X	X	N/A			TWIST2D.CTL		
Z		X		N/A			UNSCENTED_KALMAN_FILTER.ctl		
Z		X		N/A			UNSCENTED_KALMAN_NEW_FUNC_GROUP.CTL		
Z		X		N/A			UNSCENTED_KALMAN_CORRECT_FUNC_GROUP.CTL		
Z	X	X	X	N/A			UTIL_PATHFINDER_CONFIG.CTL		
Z	X	X	X	NA			UTIL_WAYPOINT.ctl		
Z		X	X	NA			UTIL_WEIGHTED_WAYPOINT.ctl		New V1.5
N/A		N/A		N/A			WAYPOINTS.CTL		Delete – obsolete
Z		X	X	NA			WEIGHTED_WAYPOINT.CTL		New V1.5
N/A		N/A		N/A			X_Y_HEADINGS.CTL		Delete – obsolete